FINAL

BACKGROUND SOIL STUDY SAMPLING AND ANALYSIS PLAN
AND
QUALITY ASSURANCE PROJECT PLAN

FOR

OPERABLE UNIT 7 OF THE LIBBY ASBESTOS SUPERFUND SITE

Revision 0 – November 2012

Prepared for:

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
Remediation Division
P.O. Box 200901
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Contract Number 407026
Contract Task Order Number 101

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Contents

Section **Page**

CONTENTS (Continued)

CONTENTS (Continued)

Section **Page**

<u>Appendix</u>

FIGURES

Figure **Page**

TABLES

Table **Page**

ACRONYMS AND ABBREVIATIONS

<	Less than
µm	Micrometer
%	Percent
±	Plus or minus
ABS	Activity-Based Sampling
AT	Averaging time
CDM Smith	CDM Smith Inc.
cc	Cubic centimeter
CoC	Chain-of-custody
CSM	Conceptual site model
DEQ	Montana Department of Environmental Quality
DQO	Data quality objective
ED	Exposure duration
EDD	Electronic data deliverable
EDS	Energy dispersive spectroscopy
EDXA	Energy dispersive x-ray analysis
EF	Exposure frequency
EPA	United States Environmental Protection Agency
ESAT	Environmental Services Assistant Team
ET	Exposure time
FBAS	Fluidized bed asbestos segregator
f/cc	Fibers per cubic centimeter
FSDS	Field Sample Data Sheet
FSP	Field Sampling Plan
ft	Feet
ft^2	Square feel
g	Gram
HASP	Health and safety plan
HHRA	Human health risk assessment
HQ	Hazard Quotient
IDW	Investigation derived waste
ISO	International Organization for Standardization
IRIS	Integrated Risk Information System

ACRONYMS AND ABBREVIATIONS
(Continued)

IUR	Inhalation unit risk factor
LA	Libby amphibole
L/min	Liters per minute
MARCH	Document Management Archive
MCE	Mixed-cellulose ester
MET	Meteorological
mm	Millimeter
MSL	Mean sea level
ND	Non-detect
OU7	Operable Unit 7
PCM	Phase contrast microscopy
PCME	Phase contrast microscopy equivalent
PDF	Portable document format
PEL	Permissible exposure limit
PLM-VE	Polarized light microscopy visual estimation
PPE	Personal protective equipment
QA	Quality Assurance
QA/QC	Quality assurance/quality control
QAPP	Quality assurance project plan
QC	Quality control
RBC	Risk based concentration
RfC	reference concentration
RME	Reasonable maximum exposure
SAB	EPA scientific advisory board
SAED	Selective area electron diffraction
SAP	Sampling and analysis plan
s/cc	Structures per cubic centimeter
s/g	Structures per gram
SOP	Standard operating procedure
SPF	Troy Sample Preparation Facility
STEL	Short term exposure limit

ACRONYMS AND ABBREVIATIONS
(Continued)

TAPE	Troy Asbestos Property Evaluation
TAS	Target analytical sensitivity
TDL	Target detection limit
TEM	Transmission Electron Microscopy
Tetra Tech	Tetra Tech EM Inc.
TWA	Time weighted average
TWF	Time Weighting Factor
UCL	Upper Confidence Limit
USACE	U.S. Army Corps of Engineers
USFS	U.S Forest Service
XRD	X-ray defraction

1.0 INTRODUCTION

Tetra Tech EM Inc. (Tetra Tech) received Task Order 101 from the Montana Department of Environmental Quality, Remediation Division (DEQ), under DEQ Contract No. 407026. As part of Task Order 101, Tetra Tech is tasked to complete soil sampling to document the presence of Libby Amphibole (LA) levels and associated mineralogy in background soil in and around Operable Unit 7 (OU7) of the Libby Asbestos Superfund Site. Tetra Tech will perform activity-based sampling activities (ABS) using the background soil. The United States Environmental Protection Agency (EPA) is the lead agency for the Libby Asbestos Superfund Site, except for OU7, where DEQ is the lead agency through a cooperative agreement with EPA. The United States Army Corps of Engineers (USACE) is supporting EPA with removal activities in OU7.

The primary objective of this Sampling and Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP) is to define soil sample collection and analysis and ABS activities needed to support development of the Human Health Risk Assessment (HHRA) for OU7 (Tetra Tech 2011). This SAP/QAPP will guide Tetra Tech background soil sampling at various sites in and adjacent to the OU7 study area and background soil ABS activities. Similar tasks are being completed in various other areas of the Libby Asbestos Superfund Site. This document includes procedures similar to OU4 background soil sample collection and background ABS data activities that were in: *Characterization of Asbestos Concentrations in Background Soils in Libby* (EPA 2010) and *Sampling and Analysis Plan, 2011 Miscellaneous Activity-Based Sampling, Libby Asbestos Site, Operable Unit 4, Revision 2 – June 2012* (CDM Smith 2012).

This SAP/QAPP includes all required elements for a field sampling plan (FSP) and a QAPP, and was developed in accordance with EPA guidance documents Environmental Protection Agency Requirements for Quality Assurance Project Plans, EPA QA/R-5 (EPA 2001) and Guidance on Systematic Planning Using the Data Quality Objectives Process, EPA QA/G4 (EPA 2006). There is no individual designated as the EPA Quality Assurance Manager (QAM) for the Libby project. Rather, the Region 8 Quality Assurance (QA) program has delegated authority to an EPA RPM. This means the EPA RPM has the ability to review and approve governing investigation documents developed by Site contractors. Thus, it is the responsibility of the EPA RPM, who is independent of the entities planning and obtaining the data, to ensure that this SAP has been prepared in accordance with the EPA QA guidelines and requirements.

This SAP/QAPP describes the sampling objectives, data quality objectives (DQO), locations, and measurement methods to support the background soil sampling objectives in OU7.

The SAP/QAPP organization is:

Section 1.0 – Introduction
Section 2.0 – Project Background
Section 3.0 – Data Quality Objectives
Section 4.0 – Sampling Program

Section 5.0 – Data Management
Section 6.0 – Quality Assurance/ Quality Control (QA/QC) Procedures
Section 7.0 – References

Tables and figures in this document follow the first reference in the text. Appendix A contains the site-specific health and safety plan (HASP), Appendix B the field forms anticipated for use during the background soil sampling and ABS, Appendix C contains the project-specific standard operating procedures (SOP) that will be followed, and Appendix D is a summary of the analytical requirements for this investigation.

1.1 BACKGROUND SOIL SAMPLING AND ABS PROJECT OBJECTIVES

The primary objective of the OU7 background study is to evaluate the potential for LA fibers to be released to the environment from soils and county rock that are not associated with the mine site at OU3. The background study data is needed as part of the HHRA for OU7. The HHRA will be used to help evaluate whether the interim removals designed for OU7 were effective in reducing the threat to human health from exposure to LA in air at OU7 properties and whether additional removal actions are needed. Determining the background level of LA, and any unique characteristics of the LA identified in OU7, are critical to establishing baseline conditions in the operable unit and an understanding of air and soil data collected. The HHRA will evaluate threats to human health from community-wide exposures to LA in air and soil at OU7.

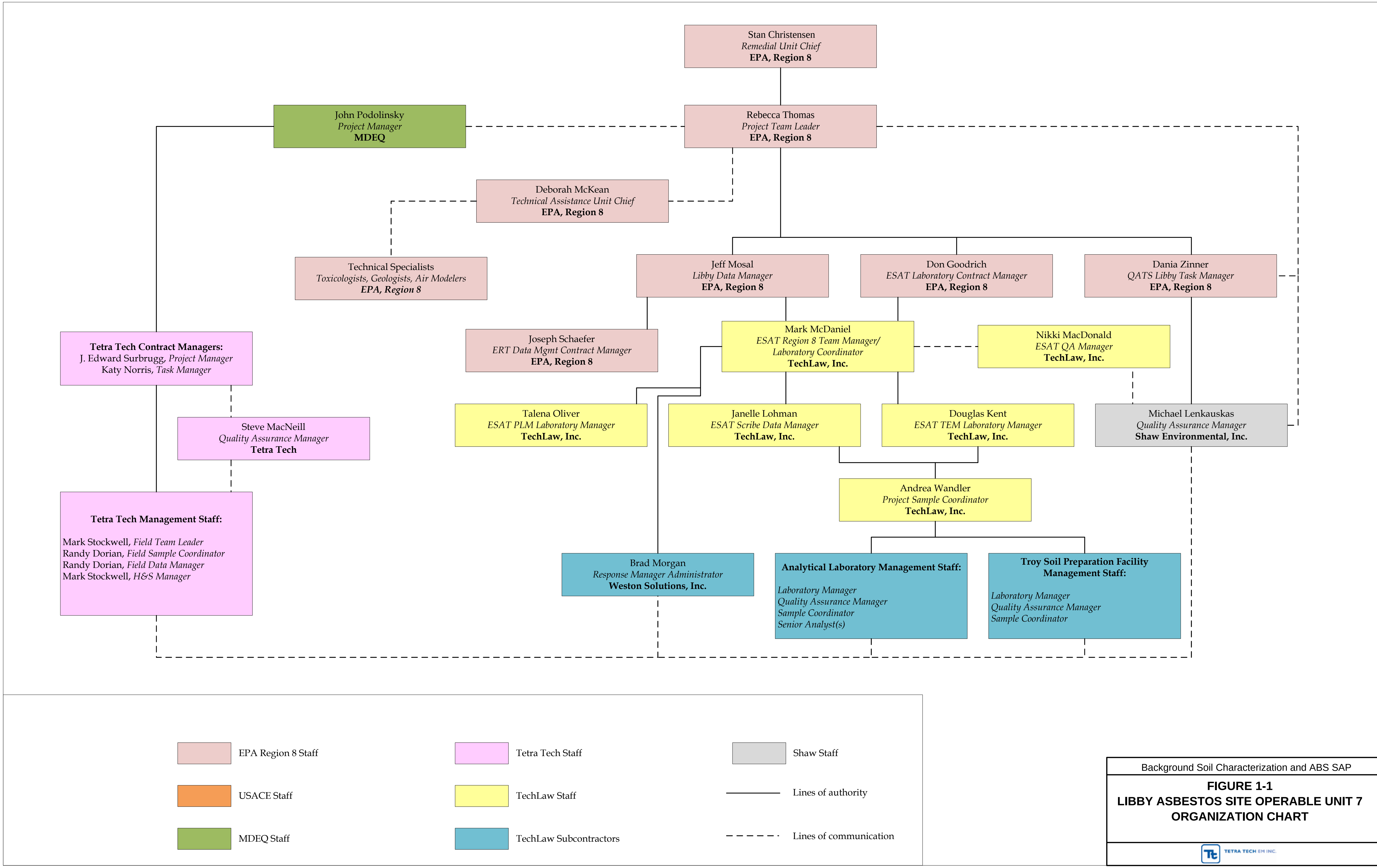
The background study data will be used to evaluate the possibility that LA fibers may be released to the air in the Troy area from naturally occurring source materials. To date, data collected for the HHRA includes: (1) ABS data for outdoor air, (2) ABS data for indoor air, and (3) ambient air data. ABS data for outdoor air, including residential and community wide activity scenarios, and ambient air are available and usable for the HHRA; ABS data for indoor air is currently being collected and analyzed, but background soils identification and associated ABS data remain as a data gap. The OU7 background study will give risk managers information needed in the HHRA.

1.2 PROJECT ORGANIZATION

This SAP/QAPP was developed by Tetra Tech (DEQ's contractor) at the direction of, and with oversight by the DEQ, with input from EPA. Tetra Tech will be responsible for all field sampling in support of the sampling programs described in this SAP/QAPP. Key Tetra Tech personnel who will be involved in these sampling programs are:

- J. Edward Surbrugg, Project Manager
- K. Norris, Task Manager
- Mark Stockwell, Field Team Leader
- Randy Dorian, Sample Coordinator and Data Manager
- Debbie Kutsal, Quality Assurance (QA) Manager
- Mark Stockwell, Health and Safety Manager

Figure 1-1 shows the general organizational structure for the OU7 team.



Background Soil Characterization and ABS SAP

FIGURE 1-1
LIBBY ASBESTOS SITE OPERABLE UNIT 7
ORGANIZATION CHART

TETRA TECH EM INC.

FIG1-1_ORG_CHART_102312.PDF CHART REVISED BY ERM TTEMI-HE

1.3 PROJECT SCHEDULE AND DELIVERABLES

The background study field activities are expected to occur during a single event. A draft report summarizing the findings from sampling will be completed once analytical results are obtained.

2.0 PROJECT BACKGROUND

From the 1920s until 1990, there was an active vermiculite mine and associated processing operation in Libby, Montana. While in operation, the mine may have produced 80 percent of the world's supply of vermiculite (EPA 2005). The processed and exfoliated vermiculite was primarily used for insulation in buildings and as a soil amendment. The Libby vermiculite deposit includes amphibole asbestos. For decades, the processing of vermiculite ore and generation and disposal of waste materials resulted in the widespread presence of amphibole asbestos throughout the Libby community. In 1999, EPA Region 8 dispatched an emergency response team to investigate media reports of abundant amphibole asbestos and high rates of asbestos-related disease in Libby. Subsequent environmental investigations found asbestos throughout many areas in and around Libby that included a form of amphibole asbestos known as Libby Amphibole.

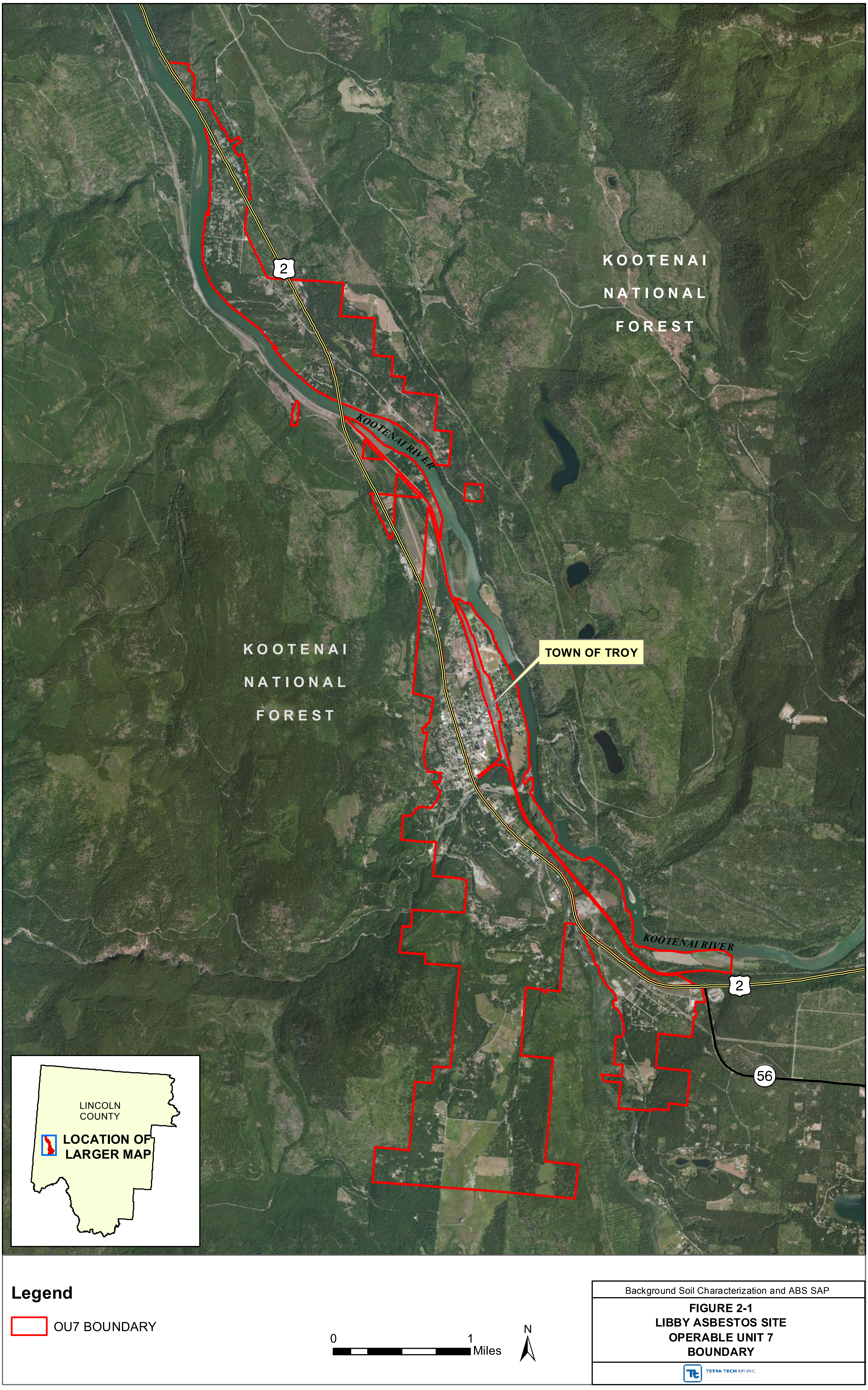
2.1 SITE LOCATION

Troy, Montana is 18 miles northwest of Libby, Montana and was designated as OU7 of the Libby Asbestos Superfund Site. OU7 is in the Kootenai River valley at elevations from 1,850 feet above mean sea level at the northern end to 2,500 feet above mean sea level on the mountain slopes surrounding the valley. OU7 is approximately 8 miles long and up to 1.8 miles wide. Topography of OU7 consists of relatively flat river valley terraces on both sides of the gently graded Kootenai River. Several tributaries flow into the Kootenai River along the 8-mile stretch of the river in OU7.

The OU7 boundary (Figure 2-1) was selected to ensure that investigations captured most of the older homes in and around Troy that are more likely to contain LA or LA source materials.

2.2 SITE HISTORY

Some of the vermiculite mine workers lived in Troy and commuted daily to work at the mine in Libby. The mine workers were exposed to asbestos-containing materials at the mine and processing facilities, and they transported asbestos-containing dust to their homes on clothes and equipment. Residents of Troy traveled to Libby for everyday activities such as shopping, working (other than at the mine), and attending school sporting events. They likely came into contact with LA in Libby during these visits. The asbestos-containing vermiculite ore and waste materials in varying forms may have been used for amending soils (as fill or as a conditioner), building materials (plaster, concrete, or chinking amendment), wood burning, and for insulating buildings in and around Troy. The ore and waste may also have been spilled or placed in transportation corridors.



Background Soil Characterization and ABS SAP

FIGURE 2-1
LIBBY ASBESTOS SITE
OPERABLE UNIT 7
BOUNDARY

TETRA TECH EM INC.

GIS map by Ed Madej TTEMI-HE
FIG2-1_OU7_BOUNDARIES_102212.mxd

A background soils study and borrow source sampling has been done in the Libby area; however, LA levels in background soil in the Troy area have not been established. It has been theorized that LA from Vermiculite Mountain may have been dispersed by glacial processes rather than by human activity during the Pleistocene period about 16,000 years before present (Langer et al. 2010).

2.3 Occurrence of Libby Amphibole

It has been thought that the source of LA throughout the Libby Superfund Site is from the W.R. Grace Mine, being transported by man, or wind-blown dust into OU7. The LA may come from one, or some combination of, primary sources outside of OU7, including vermiculite mining waste, vermiculite ore, vermiculite processing waste, bulk residuals from vermiculite processing, LA-containing rock, or LA-containing vermiculite insulation. Although there are no major sources of LA in OU7, residential use of vermiculite from the Libby mine, primarily as building insulation and as a soil amendment, was common. In some cases, vermiculite insulation was found after it sifted from the attic into interior and exterior walls. In rare cases, vermiculite was found as an additive in building materials such as plaster, mortar, and concrete.

The LA-containing soil found in OU7 is generally associated with vermiculite used as a soil amendment in flowerbeds and gardens, for leveling of low spots, and for backfilling of utilities.

Previous studies (Langer et al. 2010 and Smith 2006) have shown two situations where potentially LA-containing sediments may have been deposited into Glacial Lake Kootenai: (1) as lake-bottom sediments derived from meltwater flowing down Rainy Creek, and (2) as lake-bottom sediments eroded from the Rainy Creek outwash and re-deposited during a re-advance of the Purcell Trench Glacier lobe (Langer et al. 2010).

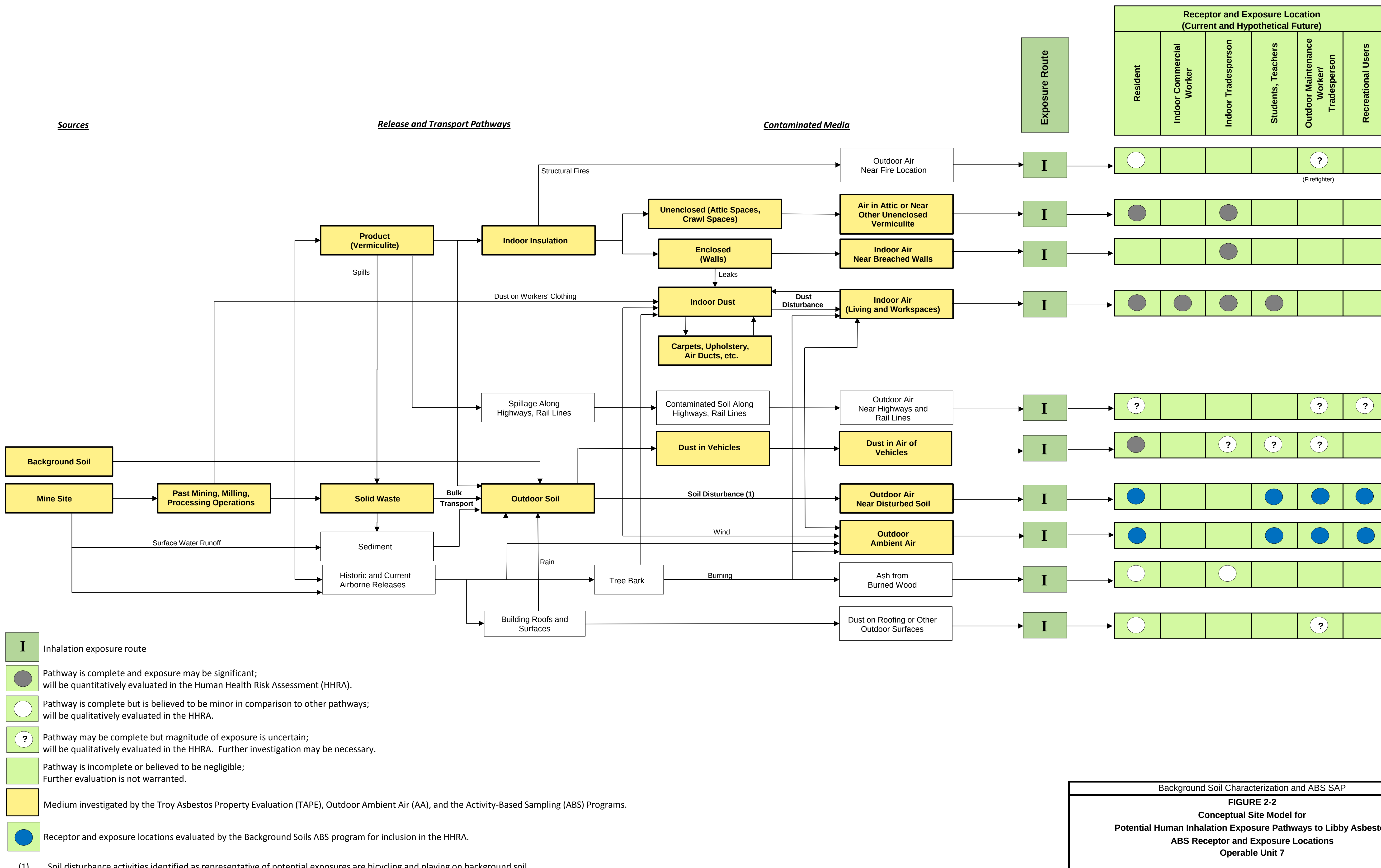
Background soil in and around OU7 may have been influenced as described above. A review of current OU7 outdoor air ABS (recreational/driving/biking) and ambient air data show that many of the LA detections lack the presence of sodium or potassium, both of which have been identified as minerals associated with the LA found at Vermiculite Mountain. To deposit LA at elevations higher than the banks of the Kootenai River catastrophic flooding would have had to occur. It is theorized that this deposition could be explained by the historic Glacial Lake Kootenai flooding. The maximum elevation of the glacial lake was about 2,450 feet above mean sea level (MSL). Therefore, LA in the Troy area derived from Vermiculite Mountain and deposited by glaciation and flooding is unlikely to be found above that elevation.

2.4 Development of HHRA Data Gaps

Since the nature of LA and associated exposure pathways in OU7 are similar to those observed in Libby, and the vermiculite insulation found in Troy is similar in morphology and mineralogy to that found in Libby, a systematic screening of interiors and exteriors of Troy area residences, public areas, schools, and businesses is being completed to gather information to determine how many Troy area properties contain LA. This systematic screening is referred to as the Troy Asbestos Property Evaluation (TAPE) (Tetra Tech 2007).

Potentially complete and significant inhalation exposure pathways for LA and the data needed to quantify human health risks for exposure pathways were identified during development of the HHRA Work Plan (Tetra Tech 2011) and from available data compiled from ongoing investigations in OU7 and OU4. The HHRA will be used to help confirm that the TAPE investigation and interim removals in OU7 were effective in reducing or removing the threat to human health from exposure to LA and whether additional removals are necessary. A full risk assessment evaluating all likely exposures and receptors will be completed when the proposed National Center for Environmental Assessment Libby Amphibole Asbestos toxicity assessment values are finalized. A conceptual site model (CSM) for potential human inhalation exposure pathways to LA was prepared as part of the HHRA work plan development and is shown in Figure 2-2.

This SAP/QAPP addresses two data gaps required to complete the OU7 HHRA: (1) characterizing LA levels in background soil in and around OU7, and (2) evaluating human health inhalation exposure to disturbed background soil through ABS. The HHRA will evaluate potential human health inhalation exposure pathways for LA to determine: (1) if there are acceptable risks (post-removal) to human health, and (2) if exposure to LA in background soils is a significant portion of the overall risk. Since it is EPA policy not to clean up soils to a concentration lower than background (EPA 2002), it is important for the DEQ and EPA to determine if naturally occurring levels of LA are found in background soil and materials in OU7.



Background Soil Characterization and ABS SAP

FIGURE 2-2
Conceptual Site Model for
Potential Human Inhalation Exposure Pathways to Libby Asbestos
ABS Receptor and Exposure Locations
Operable Unit 7

TETRA TECH EM INC.

3.0 DATA QUALITY OBJECTIVES

The DQO process is a series of planning steps designed to ensure that the type, quantity, and quality of environmental data used in decision-making are appropriate for the intended purpose. The DQOs were developed in accordance with EPA guidance (EPA 2006).

DQOs help to clarify the study objectives, define the most appropriate data to collect and the conditions under which to collect the data, and specify tolerable limits on decision errors that will be used as the basis for establishing the quantity and quality of data needed to support decision-making. The DQOs are used to develop a scientific and resource-effective design for data collection.

The DQO process consists of seven steps; output from each step influences the choices that will be made later in the process. These steps are:

1. State the problem
2. Identify the decision
3. Identify the inputs to the decision
4. Define the study boundaries
5. Develop decision rules
6. Specify tolerable limits on decision errors
7. Optimize the investigation design

3.1 STEP 1 – STATE THE PROBLEM

DEQ has completed extensive outdoor ABS throughout OU7, seeking to characterize airborne levels of LA that occur in association with soil disturbances. In some cases, these studies have detected LA structures in ABS air samples collected in locations where the soil does not appear to be contaminated based on site knowledge, PLM analysis, or visible vermiculite ranking (EPA 2010). LA structures have been detected in ambient air samples throughout OU7 over two years of sample collection. These detections raise the possibility that there is some non-zero level of LA in soils of the Troy Valley that is not attributable to anthropogenic releases from vermiculite mining and processing. If so, it is important for risk managers to have information on the exposure and risk from LA due to disturbances of background soil so they can provide a frame of reference in the interpretation of estimated site risks. It is important for risk managers to gather data on the nature and magnitude of these naturally-occurring levels to help provide information on the nature and extent of potential site-related contamination. Therefore, data are needed to provide information on measured outdoor ABS air concentrations and soil levels of LA at locations that are representative of background soil conditions throughout OU7.

As LA has been detected in ambient air samples and soils that are not related to the mine site, two remaining data gaps must be addressed to complete the OU7 HHRA: (1) determining LA levels and distribution in background soil in and around OU7, and (2) determining inhalation risk related to exposure during disturbance of background soils and its contribution to overall site risk.

DEQ and EPA need to answers these questions:

- What is the level of LA in background soils of the Troy Valley that are not attributable to anthropogenic releases?
- What is the source of LA detections in ambient air and ABS air samples in areas not obviously affected by anthropogenic sources of LA?
- If levels of LA fibers are present in background soils, what is the risk of exposure related to disturbance of background soils?
- What portion of overall site risk can be attributed to exposure to LA in background soils?

3.2 STEP 2 – IDENTIFY THE DECISION

This step identifies what questions the background soil and ABS project is designed to answer and what actions may result. The principal questions and possible alternative actions are in Table 3-1.

3.3 STEP 3 – IDENTIFY THE INPUTS TO THE DECISION

This step identifies the information and measurements needed to resolve the decision statements. The information needed to resolve the principal study questions is summarized in Table 3-2.

The data needed to achieve the objectives of this effort consist of accurate and reliable measures of LA in background soil and in outdoor air during ABS activities. The following sections identify key attributes of the data needed for this effort.

TABLE 3-1
PRINCIPAL STUDY QUESTIONS AND ALTERNATIVE ACTIONS

Response Item Evaluated	Principal Study Question(s)	Alternative Actions
Determine presence of LA in background soils in and around OU7	Is LA present in OU7 background soils; and if present, what is the nature (chemical composition) and magnitude (concentration and distribution) of LA in background soils? Is LA-containing background soil the source of LA detections in ambient air and ABS air samples?	▪ Collect background soil samples from areas not affected by anthropogenic sources of LA. ▪ Take no action
Determine LA exposure from disturbance of background soils in the OU7 area	What are the cancer risks and non-cancer hazards for individuals that inhale LA in air from OU7 background soils during soil disturbances?	▪ Perform ABS using background soil samples from areas not affected by anthropogenic sources of LA. ▪ Take no action

Notes: The method EPA currently recommends for estimating excess risk of lung cancer and mesothelioma and non-cancer hazards from inhalation exposure to asbestos in air is based on EPA's "Framework for Investigating Asbestos-Contaminated Superfund Sites" (EPA 2008). EPA's Integrated Risk Information System (IRIS) (EPA 2012a) currently presents an asbestos inhalation unit risk factor (IUR) of 0.23 (fiber/cubic centimeter)$^{-1}$ (f/cc)$^{-1}$; EPA's IRIS does not present a reference concentration (RfC) for asbestos. EPA Region 8 has developed a proposed IUR for LA of 0.17 f/cc^{-1} and a proposed RfC for LA of 0.00002 f/cc (EPA 2011). These toxicity factors are currently undergoing review by EPA's Scientific Advisory Board (SAB) and may be revised as new toxicity data on asbestos are obtained. Therefore, all evaluations of protectiveness that are based on currently proposed LA-specific toxicity factors should be viewed as interim; these interim decisions may be revised as methods and data for assessing the cancer and non-cancer risks of asbestos are improved.

ABS Activity-based sampling
LA Libby Amphibole
OU7 Operable Unit 7

TABLE 3-2

SUMMARY OF INPUTS TO RESOLVE STUDY QUESTIONS AND USE OF INFORMATION ACQUIRED FROM INPUTS

Principal Study Question(s)	Input to Resolve Question	Use of Input to Resolve Question
Is LA present in OU7 background soils; and if present, what is the chemical composition and concentration of LA in background soils? Is LA-containing background soil the source of LA detections in ambient air and ABS air samples?	Background soil samples from areas not affected by anthropogenic sources of LA	The results of the background soil sampling will be used to determine the nature and extent of LA in areas not affected by anthropogenic sources of LA, and modify cleanup goals for OU7 soils that have been affected by anthropogenic sources of LA.
What are the cancer risks and non-cancer hazards for individuals that inhale LA in air from OU7 background soils during soil disturbances?	Air samples in the breathing zone during background soil ABS.	The results of the air samples collected during background soil ABS will be used to determine the cancer risk and non-cancer hazards associated with background soil LA concentrations. The Background Study will help determine if some exposures are unavoidable due to the presence of LA or other mineral fibers in background soils and air. .

Notes:

LA	Libby Amphibole
ABS	Activity-based sampling
OU7	Operable Unit 7
HHRA	Human Health Risk Assessment

3.3.1 Soil Concentrations of LA

Measured data are needed on the concentration of LA in background soils to determine the associated mineralogy. Soil samples should be collected using a sampling design that allows for estimation of the average level of LA in the soil (i.e., a single multi-point composite sample or multiple single-point samples from which a mean can be calculated). Results should provide an estimate of the level (e.g., mass percent [wt%], asbestos structures per gram [s/g] of soil) of LA in soil.

If present, LA levels in background soils are likely to be low (less than 0.1%), thus analysis by polarized light microscopy visual estimation (PLM-VE) may not be informative. Preliminary method performance evaluations show that Transmission Electron Microscopy (TEM) analyses of soil prepared using the Fluidized Bed Asbestos Segregator (FBAS) method were able to reliably quantify LA concentrations of 0.005% and lower in soil (Januch *et al.* 2011). Therefore, soils from background areas will be analyzed for asbestos by TEM after preparation using the FBAS method.

Additionally, because it is possible that the type of LA in background soils, if present, may be different from the type of LA derived from the Libby ore body at the mine site, results should include the size attributes (length, width, aspect ratio) of each asbestos structure observed, along with the mineral classification (LA, other amphibole, chrysotile). Information on the sodium and potassium content of each LA structure observed, as determined by energy dispersive spectroscopy (EDS), should be recorded.

Field-based visual estimates of the level of vermiculite in soil should be recorded for each background soil sample. These visual estimates can be used to provide information on the relative level of LA in soil (e.g., a weighted "score"), but do not provide absolute concentration estimates.

3.3.2 ABS Air Concentrations of LA

The information needed to characterize human exposures consists of reliable measurements of LA concentrations in air under realistic and representative exposure scenarios that are characteristic of soil-disturbing activities at locations that are representative of background soil conditions.

ABS Design

There are two potential study designs that could be used to evaluate ABS for background soils:

1) *Perform outdoor ABS at each background sampling location.* The advantage of this approach is that it provides a direct measure of LA in ABS air during disturbances of background soils. A potential disadvantage of this approach is that it may be difficult to

access and conduct representative ABS in areas that are representative of background (i.e., often locations are remote).

2) *Perform outdoor ABS at a standardized location using soil obtained from each background sampling location.* The advantage of this approach is that it provides a direct measure of LA in ABS air during disturbances of background soils under a controlled set of conditions. This approach has the advantage that ABS can be completed in any season at any standardized location (i.e., it is not necessary that ABS be performed in OU7 during the field season). A potential disadvantage of this approach is that local conditions could influence measured air concentrations, but this issue could be mitigated through the selection of the ABS area and use of appropriate control measures at the selected ABS area.

Of these two potential study designs, it is likely that the latter approach (i.e., the *ex situ* design) will be the most feasible to implement for multiple samplings on soils from multiple background areas under a standardized set of ABS conditions.

Disturbance Activities

People may disturb soil or other LA source materials by a variety of different activities. It is not feasible to evaluate every possible type of disturbance, so ABS should be performed using selected scenarios considered to be realistic and representative examples of disturbances in OU7, in particular, residential disturbance activities. Previous outdoor ABS efforts at residential yards in OU7 included relatively vigorous (high-end) disturbances, such as raking the lawn with a metal-tined leaf rake, digging in the soil with a shovel, and mowing the lawn.

The background soil sampling program should use an ABS disturbance scenario that has a high probability of resulting in measureable ABS air concentrations of LA, if it is present. OU7 outdoor ABS results from 2011 show that residential activities including bicycling, digging and simulating a child playing in gravel driveways, and adult conducting yard work including raking, digging and mowing yielded the highest ABS air concentrations of LA. This sampling program uses a digging scenario, simulating a child playing in dirt, as in Libby this scenario, had the highest reported LA concentrations.

Type of Air Sample

As noted previously, asbestos sampling experience demonstrated that personal air samples collected during source-disturbance activities are more representative of breathing zone exposures and tend to have higher concentrations than stationary monitor air samples. Because of this, this study should focus on the collection of personal air samples during ABS.

Target Analyte List

ABS air samples should be analyzed for asbestos using TEM. Because it is possible that the type of LA in background soils, if present, may be different from the type of LA derived from the Libby ore body at the mine site, results should include the size attributes (length, width, aspect ratio) of each asbestos structure observed, along with the mineral classification (LA, other amphibole, chrysotile). Information on the sodium and potassium content of each LA structure observed, as determined by EDS, should also be recorded.

3.3.3 Other Data

Release of LA from soil into air is expected to depend on several environmental factors that may vary over time. These factors may include meteorological conditions (temperature, wind) and soil conditions (soil moisture). It may be helpful to evaluate ABS air concentrations as a function of these environmental factors to improve the ability to interpret air results as a function of soil conditions. Therefore, measurements of soil moisture should be estimated when ABS is conducted. Meteorological weather station data (MET) should be downloaded from the Troy weather station at the DEQ Information Office for days when ABS activities are scheduled.

3.4 STEP 4 – DEFINE THE BOUNDARIES OF THE STUDY

This step specifies the spatial and temporal boundaries of the background study

3.4.1 Spatial Bounds

The spatial bounds of this study should be restricted to areas that are representative of background conditions in surficial soil (0-6 inches beneath duff and vegetative material) in and around OU7.

3.4.2 Temporal Bounds

In general, it is expected that human exposures to LA in outdoor air are more likely to occur when snow cover is limited or absent, and that releases will tend to be higher during dry than wet conditions. So, ABS should be performed when conditions for asbestos release are generally favorable. ABS sampling should not occur if rainfall in the past 36 hours has exceeded ¼ inch. ABS sampling should not occur if there is standing water present or if the average volumetric water content is greater than 30 percent, measured with field probe instrumentation.

During days when background ABS activities are scheduled, MET data will be downloaded from the weather station at the DEQ Information Office in Troy. Weather data will include temperature, relative humidity, wind speed and direction, and any precipitation type and accumulation.

3.5 STEP 5 – DEVELOP DECISION RULES

This step describes the method to determine whether the data collected indicate acceptance and the decision to be applied when acceptance is not obtained. The principal study questions, inputs to resolve study questions, action levels, and decision rules are summarized in Table 3-3.

TABLE 3-3
DECISION RULES

Principal Study Question(s)	Input to Resolve Question	Input Requirements	Action Level	Decision Rule
Is LA present in OU7 background soils; and if present, what is the chemical composition and concentration of LA in background soils? Is LA-containing background soil the source of LA detections in ambient air and ABS air samples?	Background soil samples from areas not affected by anthropogenic sources of LA	Sample preparation by FBAS in accordance with project-specific SOP ESAT-Libby-01, Rev. 0 (Appendix C), and analysis by TEM/EDS & SAED, in accordance with ISO 10312 (ISO 1995), with project-specific modifications listed in Appendix D.	To be determined	If background soil samples contain quantifiable levels of LA these levels will be used in the development of cleanup goals for OU7 soils that have been affected by anthropogenic sources of LA.
What are the cancer risks and non-cancer hazards for individuals that inhale LA in air from OU7 background soils during soil disturbances?	Air samples in the breathing zone during background soil ABS.	Sample preparation and analysis by TEM, in accordance with ISO 10312 (ISO 1995), with project-specific modifications listed in Appendix D.	To be determined	If background soil ABS sample results are found to contain quantifiable levels of LA results will be included in the HHRA uncertainty analysis

Notes:

ABS	Activity-Based Sampling
EDS	Energy dispersive spectroscopy
ESAT	Environmental Services Assistant Team
FBAS	Fluidized Bed Asbestos Segregator
HHRA	Human health risk assessment
ISO	International Organization for Standardization
LA	Libby Amphibole
OU7	Operable Unit 7
SAED	Selective area electron diffraction
SOP	Standard Operating Procedure
TEM	Transmission Electron Microscopy

The decision rule for evaluating residual risks from disturbance of background outdoor sources is:

> If the level of risk to humans from breathing air affected by disturbing background soils, when combined with the level of risk that applies to the same individuals from other applicable exposure pathways does not exceed a cancer risk of 1E-04 or a non-cancer Hazard Quotient (HQ) of 1.0, then risks at that location will be considered acceptable. If the total risk exceeds a cancer risk of 1E-04 or an HQ of 1.0, then risk management decisions will be evaluated and may likely include implementation of institutional controls. EPA developed a quantitative procedure for quantifying cancer risk and non-cancer hazard based on EPA's framework (EPA 2008).

The basic risk equation is:

$$\text{Risk(i)} = \text{C(i)} \cdot \text{TWF(i)} \cdot \text{IUR(i)}$$

where:

Risk(i)	=	Risk of dying from a cancer that results as a consequence of exposure from specified exposure scenario "i"
C(i)	=	Average concentration of asbestos fibers in air in units of fibers per cubic centimeter (f/cc) during exposure scenario "i"
IUR (i)	=	Inhalation Unit Risk (f/cc)-1 that is appropriate for exposure scenario "i"
TWF(i)	=	Time weighting factor for exposure scenario "i". This factor accounts for less than-continuous exposure during the exposure interval.

Because each person can be exposed to more than one source, the total cancer risk is calculated by summing the risks from each exposure pathway that applies:

$$\text{Total risk} = \sum \text{Risk(i)}$$

The basic hazard equation is:

$$\text{Hazard(i)} = (\text{C(i)} \cdot \text{TWF(i)})/\text{RfC(i)}$$

where:

Hazard(i)	=	Hazard of developing non-cancer health effects as a consequence of exposure from specified exposure scenario "i"
C(i)	=	Average concentration of asbestos fibers in air in units of fibers per cubic centimeter (f/cc) during exposure scenario "i"
RfC (i)	=	Reference Concentration (f/cc) that is appropriate for exposure scenario "i"
TWF(i)	=	Time weighting factor for exposure scenario "i". This factor accounts for less than-continuous exposure during the exposure interval.

Because each person can be exposed to more than one source, the total non-cancer hazard is calculated by summing the hazards from each exposure pathway that applies:

Total non-cancer hazard = $\sum$ Non-Cancer Hazard (i)

This document is focused on methods for collecting data on the concentration of asbestos in background soils and for the breathing zone of people who are engaged in activities that disturb the background soils. These data will be used to evaluate the risk and non-cancer hazard from the outdoor source-disturbance pathway. These risks and non-cancer hazards will be combined with risk and non-cancer hazard estimates for other pathways to estimate total risks and non-cancer hazards. Because of limitations in the current methods for assessing risks and non-cancer hazards from asbestos, all decisions regarding residual risk and non-cancer hazard levels are considered interim and may be revisited as new methods and data become available.

3.6 STEP 6 – SPECIFY TOLERABLE LIMITS ON DECISION ERRORS

This step specifies the tolerable limits on decision errors used to establish performance goals for the data collection design.

In making decisions about the long-term average concentration of LA in background soils and in background soil ABS outdoor air and the level of health risk associated with that exposure, two types of decision errors are possible for each decision category:

Background Soil LA Concentrations

- A false negative decision error would occur if risk managers decide that LA is not present in background soils when in fact it is.

- A false positive decision error would occur if risk managers decide that LA is present in background soils when in fact it isn't.

Background Soil ABS Outdoor Air

- A false negative decision error would occur if a risk manager decides that exposure to background soil ABS outdoor air is not of significant health concern when in fact it is of concern.
- A false positive decision error would occur if a risk manager decides that exposure to background soil ABS outdoor air is above a level of concern when in fact it is not.

EPA and DEQ are most concerned about guarding against the occurrence of false negative decision errors because this error type may leave humans exposed to unacceptable levels of LA in outdoor air.

For this reason, it is anticipated that decisions regarding this pathway will be based not only on the best estimate of the long term average concentration (mean), but will also consider the minimum and maximum concentrations. The use of the minimum and maximum concentrations in addition to the mean concentration will provide risk managers with a range of potential risks and uncertainties related to the asbestos concentrations.

EPA and DEQ are also concerned with the probability of making false positive decision errors. Although this type of decision error does not result in unacceptable human exposure, it may cause unnecessary expenditure of resources. For this effort, and consistent with CDM (2012), the strategy for controlling false positive errors is to "limit the probability of a false positive decision error to no more than 20 to 30 percent when the true risk is less than one-half the level of concern."

For completing all seven steps of the DQO process, the null hypotheses and consequences of making an incorrect decision are summarized in Table 3-4. The gray region and tolerable limits on decision errors are not proposed because they are not applicable in this case.

3.7 STEP 7 – OPTIMIZE THE INVESTIGATION DESIGN

This step identifies a resource-effective data collection design for generating data to satisfy the DQOs. The data collection design is described in detail in the remaining sections of this SAP/QAPP and other site documents referenced in Section 4.0.

TABLE 3-4
LIMITS ON DECISION ERRORS

Principal Study Question(s)	Null Hypothesis	Type I Error Will Result in:	Type II Error Will Result in:
Is LA present in OU7 background soils; and if present, what is the chemical composition and concentration of LA in background soils? Is LA-containing background soil the source of LA detections in ambient air and ABS air samples?	Concentrations of LA in background soils exceeds a specified level	Determining that background soil samples do not contain detectable levels of LA when they actually do would lead to exaggerated removal trigger levels that would otherwise be reduced by the presence of LA in background soils.	Determining that background soil samples do contain detectable levels of LA when they actually do not would lead to an increased risk to human health as cleanup trigger levels would be set higher, potentially reducing the scope of, or eliminating cleanups.
What are the cancer risks and non-cancer hazards for individuals that inhale LA in air from OU7 background soils during disturbance activities?	Disturbance of background soil at areas not impacted by anthropogenic sources of LA exceeds a specified level.	Determining that background soil ABS outdoor air samples do not exceed a specified level when airborne LA actually does exceed this level would lead to an increased risk to human health.	Determining that background soil ABS outdoor air samples do exceed a specified level when airborne LA does not exceed this level would lead to unnecessarily performing removals or inefficiency during removals that adds to removal costs.

Notes:
ABS Activity-based sampling
LA Libby Amphibole
OU7 Operable Unit 7

4.0 BACKGROUND STUDY SAMPLING PROGRAM

This section summarizes procedures for collecting background soil samples and completing background soil-related activity-based air sampling in OU7. Methods and procedures presented below are consistent with those previously used in other areas of the Libby site and are referenced from the following documents:

- 2010 Characterization of Asbestos Concentrations in Background Soils in Libby, Initial Range-Finding Pilot Study (EPA 2010), and

- Sampling and Analysis Plan, 2011 Miscellaneous Activity-Based Sampling, Libby Asbestos Site, Operable Unit 4, Revision 2 (CDM Smith 2012)

The site-specific HASP (Appendix A) should be consulted to determine health and safety protocols for background soil collection and background soil ABS work. Tetra Tech's field team leader and site safety coordinator (Mark Stockwell) will oversee and direct field activities and has day-to-day responsibility for implementing the HASP. Mr. Stockwell has the appropriate level of training and advanced level of field work experience to be familiar with health and safety requirements specific to the project. The field team leader will report any health and safety-related issues directly to the project manager (J. Edward Surbrugg) who will communicate these issues to the Regional Health and Safety Officer for resolution. All Tetra Tech employees working on the Background Soil Study and ABS project are expected to fully participate in implementing the site HASP by obtaining necessary training, attending site safety meetings, always wearing designated PPE, complying with site safety and health rules, and advising the SSC of health and safety concerns at the site. Field forms and project-specific SOPs are in Appendices B and C.

All sampling activities will be done in accordance with this SAP/QAPP. The SOPs and project-specific procedures to be employed are outlined in:

- 2007 OU7 Troy Area Property Evaluation (TAPE) Sampling and Analysis Plan (Tetra Tech 2009), and
- 2011 Activity-Based Sampling SAP for Operable Unit Number 7 of the Libby Asbestos Superfund Site (Tetra Tech 2011)

Background soil sampling procedures start with Section 4.1 and Background soils ABS procedures start with Section 4.6. Analytical methods for all samples collected in accordance with this SAP/QAPP are discussed in detail in Sections 4.2 (background soil) and 4.8 (ABS).

4.1 BACKGROUND SOIL SAMPLE COLLECTION

The following sections provide a general summary of the procedures for collection of background soil. The purpose of this study is to collect and analyze soil samples that will provide an initial characterization of the concentrations and distribution of background levels of LA and potentially other forms of asbestos in Troy Valley soils.

4.1.1 Selection of Background Soil Sampling Locations

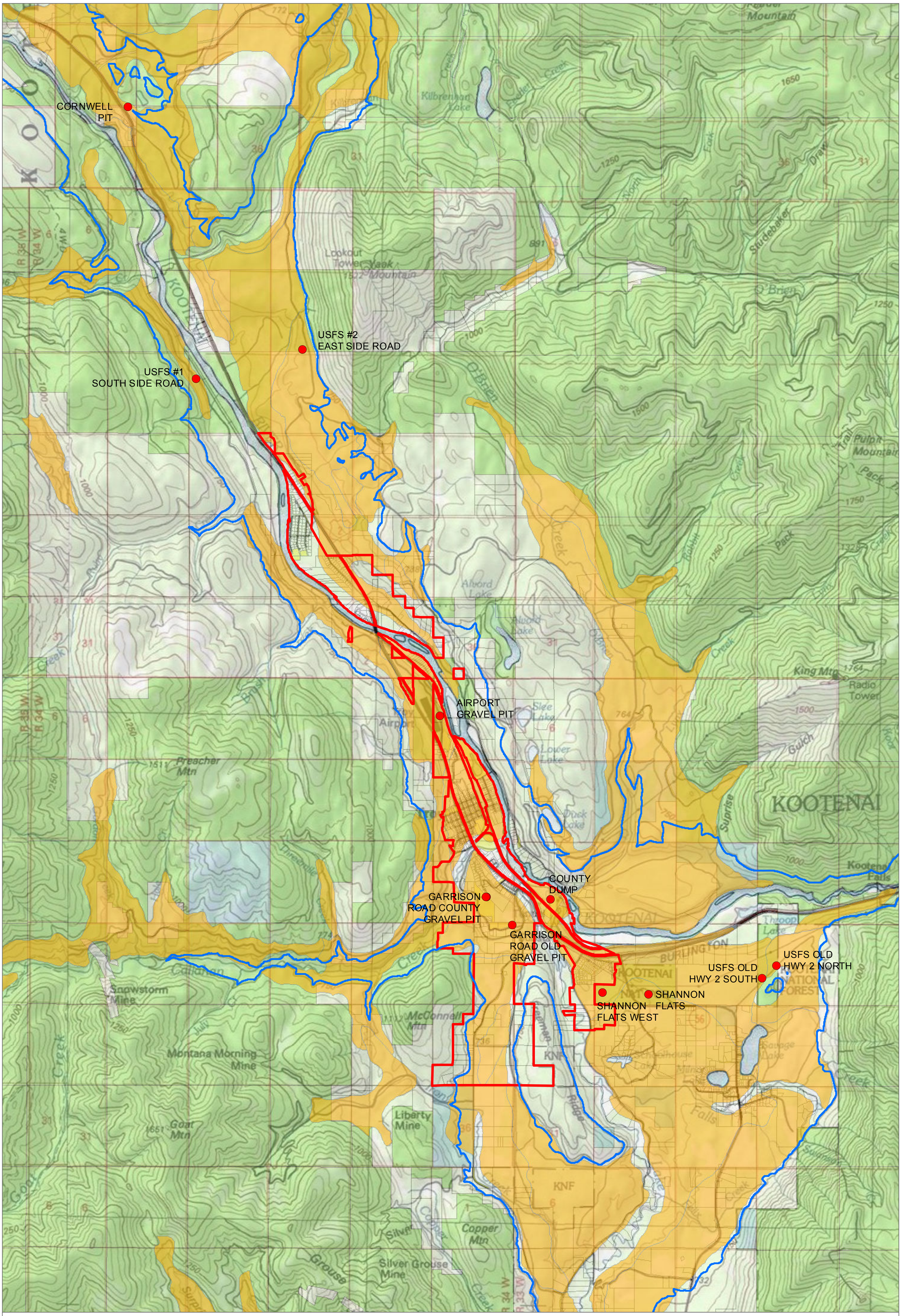
Selection of soil sampling locations that will be representative of background is complicated by several factors:

- Because of the complex geology and geological history of the area, soils in the Troy Valley may differ in their mineral compositions from location to location—what is background in one location may not be representative of background in all locations.
- Human activities, such as construction of buildings and roads, often results in substantial disturbance of soils, and may involve moving soils from one location to another. To the extent that soils may differ from location to location, soils in the area of human disturbances may not necessarily be representative of background at that location.
- Historic releases of vermiculite from the mine and from other vermiculite processing and transporting facilities may have resulted in the deposition of vermiculite and LA in soils, altering their asbestos content compared to what would have been present had the mine never operated.

Based on these factors, the following criteria are to be used in the selection of locations for collection of background soil samples:

1. To facilitate access, all locations shall be on City, County, State, or Federal land or lands currently being leased by a government entity.
2. All locations shall be in or near the Troy Valley at an elevation no higher than the maximum level of the historic glacial lake level (i.e., 2.450 feet above MSL).
3. There shall be no evidence of historic or recent anthropogenic activities (in the past 50-100 years) that would have resulted in substantial disturbance or mixing of soil.
4. Locations shall not be within about 100 meters of any known or suspected local vermiculite emission sources (e.g., railroads, highways).
5. Not representative of clean fill material.
6. No visible vermiculite should be observed.

Figure 4-1 identifies a number of areas in the Troy Valley that have been selected using these criteria. Up to 10 background soil sampling stations within these candidate sites will be selected for sampling. Tetra Tech will collect two 30-aliquot background soil samples at each sampling location.



Background Sampling Location

Maximum Elevation of Glacial Lake (2,450 feet above sea level)

Soil mapping Units 102, 106, 108, and 110. Lacustrine Sediments and Glacial Outwash Sediments

Basemap Source: USGS
Parcel Info: Montana Cadastral Database, Montana Dept. of Administration, Information Technology Services Division
SURRGO Soils: NRCS

Property Ownership

- Federal
- State Land
- Local Government
- Private
- Operable Unit 7 Boundary

0 1,050
Meters

Background Soil Characterization and ABS SAP

FIGURE 4-1
LIBBY ASBESTOS SITE OPERABLE UNIT 7
BACKGROUND SAMPLING LOCATIONS

TETRA TECH EM INC.

GIS map by Ed Madej Tetra Tech HE
FIG4-1_BACKGROUND_SAMPLING_LOCATIONS_110912.MXD

4.1.2 Pre-Sampling Activities

Before beginning field activities, a kickoff meeting will be held, required training will be completed, and appropriate site specific instructions will be given to the field team.

Ten sampling locations will be chosen from the potential sites shown on Figure 4-1. To the extent possible, the locations will be selected to provide a geographically representative distribution across OU7. All sampling locations are on public lands (such as County, U.S. Forest Service [USFS] and State lands or County leased lands).

Property-specific information will be collected for each sampling location and recorded on the Background Soil/ABS Field Form (Appendix B).

4.1.3 Field Planning and Required Equipment and Supplies

Before field crews mobilize, Tetra Tech will prepare detailed property maps identifying the OU7 background sampling locations to be included. The background soil sampling schedule will be refined as Tetra Tech schedules the background sampling location dates and times.

The Tetra Tech field manager will do an inventory of project-procured equipment and supplies before beginning and obtain any additional required equipment or supplies. The following equipment is required for sampling:

- Field logbooks
- Indelible ink pens
- Digital camera with memory card
- Sample paperwork and sample tags and labels
- Custody seals
- Plastic zip-lock bags
- Five-gallon clean plastic buckets
- Shovels and trowels
- Personal protective equipment (PPE) as required by site-specific HASP (Appendix A)
- Location-specific site diagrams
- Standard hand tools (screwdrivers, hammer, wrenches, etc.)

4.1.4 Collection of Background Soil Samples

Ten background soil sampling locations will be identified in locations known to contain glacial lake sediments throughout the Troy Valley. General sampling locations are shown on Figure 4-1. Each background sampling location shall consist of one approximately 300 square feet (ft) (e.g., 15 ft x 20 ft) area. Two independent 30-point composites shall be collected from each area. Each composite shall be representative of the entire area of the sampling location. This shall be accomplished by laying out approximately 30 grid nodes uniformly place within the sampling area. Two independent grab samples will be collected within about 1-2 feet of each grid node. The first grab sample shall be placed into the first composite container, and the second sample shall be placed into the second composite container. This procedure should be continued until all 30 grid nodes have been sampled. Exact grid node locations may be adjusted as needed to avoid local obstructions such as trees, rocks, etc. Approximately 500 grams of soil will be collected from each of the two composite samples for laboratory analysis. Table 4-1 provides a summary of background soil sampling activities.

After collection of the two grab samples at each grid node, an additional two soil aliquots will be collected and will be composited into a 5-gallon bucket for future use during the background soil ABS study.

At each grab sample location, samples shall be collected using a 1-inch stainless steel coring device, trowel, or shovel to expose the soil to approximately 6 inches deep. Prior to sample collection, loose organic debris (e.g., leaves, pine needles, duff) should be manually removed. Soil samples should be collected in accord with SOP CDM-LIBBY-05, Revision 2, Soil Sample Collection at Residential and Commercial Properties (see Appendix C), with the following project-specific modifications:

- Sample aliquots will be collected using a 1-inch stainless steel coring device (e.g., soil push probe) or other device such as a trowel or shovel.

- All sample areas will be pre-determined and will not require a use area designation.

- The top 1 inch of each core shall be removed to minimize the potential contribution of historic deposition of airborne LA released from past mining, milling, and transporting activities. The 0-1 inch interval of each core sample for each composite shall be combined, coarsely mixed and homogenized in a stainless steel bowl in the field, and archived for possible future analysis. This sample collection approach is comparable to the procedure used for the collection of a field duplicate soil composite sample.

- The entire 1-6 inch interval of each core sample for each composite shall be combined and coarsely mixed and homogenized in a stainless steel bowl in the field. The field team should note if soil horizons are visually apparent within this depth interval, the thickness of these horizons, and the soil's appearance (e.g., color, grain size).

- Soil samples will be transferred to the DEQ Information Center, prepared and submitted to the Troy Sample Preparation Facility (SPF) and stored for ABS activities under chain-of-custody (CoC) and transported to the appropriate laboratory for preparation and analysis.

Table 4-1
Locations, Activities, and Number of Samples for Background Study at OU7

Soil Samples	Location	Collection Technique	Soil Volume	Use/Analysis	Number of Samples	Notes
Background Soil For FBAS/TEM and ABS	Background Soil - 10 Locations	Two independent 30-point composite samples from 0-1" bgs (300 ft^2 area)	500 gram zip-top bag (each sample)	Archive only	20	Two independent 30-point grab samples will be collected from a 300 ft^2 grid area at each background location. Each sample will thoroughly composited and the two samples from each background location will be archived.
	Background Soil - 10 Locations	Two independent 30-point composite samples from 1-6" bgs (300 ft^2 area)	500 gram zip-top bag (each sample)	Background Soil for FBAS/TEM Analysis	20	Two independent 30-point composite samples will be collected from a 300 ft^2 grid area at each background location. Each sample will be thoroughly composited, then placed in a zip-top bag for delivery to the SPF. ESAT will split into three subsamples for 1) LA and Mineralogy, 2) PLM-VE, and 3) archive sample.
	Background Soil - 10 Locations	Two independent 30-point composite samples from 1-6" bgs (300 ft^2 area)	5-gallon bucket	Child playing/digging ABS scenario	10	A single 5-gallon bucket of soil (consisting of 60 aliquots) will be collected from each background location using the same techniques as described for the FBAS/TEM samples. The soil will be used to perform ABS for the child digging scenario described below. A high and low volume pump will be worn by the field staff and one of the two resulting air samples will be selected for TEM analysis.

ABS Scenario	Location	Receptor	Age Group	Sample Height	Activity	Activity Time	Locations per Scenario	Events per Location (a)	Total Samples per Scenario
Background ABS	Background Soil (5-gallon bucket); Moved to Off-Site Location for ABS	Resident	Child	Breathing Zone for Child	Digging	120 Minutes of Digging/Homoginizing Background Soil	10	1	10

Notes:
ABS: Activity-based sampling
ESAT: Environmental Services Assistance Team
FBAS: Fluidized bed asbestos segregator
PLM-VE: Polarized light microscopy visual estimation
TEM: Transmission Electron Microscopy
LA: Libby Amphibole
TEM: Transmission Electron Microscopy

4.1.5 Sample Labeling and Documentation

A unique alphanumeric code, or sample ID number, will identify each sample. The coding system will provide a tracking record to allow retrieval of information about a particular sample and to ensure that each sample is uniquely identified. Sample IDs will be sequential and not be representative of any particular soil sample. Sample IDs will correlate with sample location IDs that will be identified in the field logbooks.

The sample labeling scheme will follow the format:

TK-XXXXX

where:

> TK identifies that a sample is collected in accordance with this Background Soil Study SAP/QAPP and XXXXX represents a 5-digit numeric code.

Preprinted adhesive sample labels will be signed out to sampling personnel by the sample database manager. The labels are controlled to prevent duplication in assigning sample IDs. The labels will be affixed to the inner and outer sample bags for background soil samples.

Note: Composite samples from the 0-1 inch depth interval and the 1-6 inch depth interval will be assigned unique Sample ID numbers. The “Location ID” field will be used to allow data managers to match the paired depth interval composites.

The field team will complete a project-specific Field Sample Data Sheet (FSDS) for each soil sample collected. Appendix B provides an example of the FSDS form.

4.1.6 Field Logbooks

Documentation of field activities will be recorded in field logbooks maintained specifically for this sampling program. Logbooks are controlled documentation (i.e., sequentially numbered) and maintained by DEQ and EPA.

The logbook is an accounting of activities at the site and will note problems or deviations from the governing plans and observations relating to the sampling and analysis program. A new logbook page will be completed for each background sampling location. The header information will include the address, and the property owner’s name. When closing out a logbook page with lineout and signature, the author will print their name underneath the signature. Original logbooks will be maintained in the DEQ Troy Information Center.

4.1.7 Photographic Documentation

Photographs will be taken with a digital camera at sampling locations and during each sampling. A description of each photograph will be recorded in the field logbook in accordance with photographic log protocol (Appendix I of TAPE work plan [Tetra Tech 2007]). A list of photographs in the field logbook will clearly state where each photograph was taken (e.g., Background Soil Site A, sample location 1). Electronic photograph files will be saved each day to a project-designated computer at the DEQ Troy Information Center and assigned appropriate metadata in the document management archive (MARCH) so that photographs for a particular ABS property or scenario can easily be retrieved.

4.1.8 GPS Point Collection

A Garmin GPS unit will be used to record the latitude and longitude at the center of each background soil sampling location. The GPS location coordinates will be recorded on in the field logbook and on the FSDS, and will be associated with the unique identification number for the background sampling location.

4.1.9 Equipment Decontamination

Stainless steel scoops and bowls will be used for soil sampling and will need to be decontaminated. If a small metal shovel is required to assist with sampling to 6 inches in hard, compacted soils, the shovel will be thoroughly cleaned and decontaminated. Decontamination will occur at the location where the sample was collected and will include spraying the equipment with distilled water followed by drying with paper towels. The water will be allowed to fall on the ground in the area just sampled and the paper towels will be placed in a labeled asbestos waste bag.

Visible soil on hands or clothing will be removed by washing with soap and water. Additional personnel decontamination procedures, including requirements for decontamination zones, are described in Section 9.2 of the HASP (Appendix A). Personal protective equipment (PPE) will include disposable gloves, disposable protective outerwear, work boots, disposable boot covers, and respirators. The respirators will be cleaned and decontaminated as discussed in the HASP (Appendix A). Materials used in the decontamination process will be disposed of as investigation derived waste (IDW) as described below.

4.1.10 Health and Safety Air Monitoring

As part of this investigation, personal air samples will be collected on the first day of sampling for ongoing health and safety monitoring. The health and safety samples will be collected using a low volume sampling pump and are not intended for use in the background soil sampling or background soil ABS study or with the risk assessment. To differentiate these samples from the other air samples, Phase contrast microscopy (PCM) will be used in the Sample Location Description field of the Worker and Work Summary form. These samples will be collected and analyzed in accordance with the 2012 OU7 HASP and will represent both the 8-hour time-weighted average (TWA) and 30-minute short-term exposure limit (STEL) for each employee work category. The permissible exposure limit (PEL) is 0.1 f/cc for the 8-hour TWA, and the STEL is 1.0 f/cc over 30 minutes as specified in 29 CFR Part 1910.1001 (j)(2)(iii).

4.1.11 Handling IDW

IDW will include used wet wipes, wet paper towels, disposable gloves, used respirator cartridges, used plastic tubing, disposable protective outerwear, plastic floor coverings, and other minimal waste. It is possible, but not likely, that this IDW may contain some asbestos. Therefore, all IDW will be double-bagged in appropriate asbestos bags, labeled with asbestos labels, and stored in an approved containment area at the Tetra Tech Troy field office until it can be properly disposed of at an approved landfill (Lincoln County outside of Libby). Non-sampling waste generated by the TAPE field teams, such as food containers and waste paper, will be separately bagged and properly disposed of as solid waste.

4.1.12 Recordkeeping and Chain-of-Custody

At the end of each day, or more often if required, the field teams will return to the DEQ Troy Information Center to download and transfer data recorded on the OU7 Background Soil/ABS Forms. The field teams will transfer the soil and air samples and any QC samples, provide copies of the appropriate logbook pages to the field sample coordinator (or the coordinator’s designee) and download digital photographs. Photographs will be electronically labeled and entered into the OU7 MARCH database. MARCH is a Microsoft Access database used to manage electronic documents and associated metadata in accordance with EPA requirements (EPA 2012b). Individual photographs will not be routinely printed. Data from the field forms will be downloaded or entered on a daily basis into a local field Scribe database. Once all data have been processed, the Scribe project will be informally published to Scribe.NET. The field database will be incorporated into the primary OU7 Scribe database, LibbyTTOU7Field, and will be formally published to Scribe.NET.

An individual file (paper and electronic) will be maintained for each background sampling location. Originals of all field forms will be kept in each individual property file in the DEQ Troy Information Center for the duration of the project. PDF copies of all field forms and appropriate logbook pages, and digital photographs will be stored in each individual electronic property file. A backup electronic copy of the files will be stored away from the DEQ Troy Information Center, and will be updated periodically for the duration of the sampling, and reporting phases of the project. Copies of all QA/QC records, forms, and field logbooks will be available to DEQ, EPA, or other appropriate parties at any time during the background soil study.

After the OU7 Background Soil/ABS form electronic information and data are entered in the local field Scribe database, the field sample coordinator will check all sample ID numbers for accuracy. The field sample coordinator will print a hard copy of the CoC form and store these records with the associated samples. The CoC report will be transferred to the ESAT Laboratory Coordinator.

Until samples have been transferred to the ESAT Laboratory Coordinator, they will be securely held by Tetra Tech. Samples may be stored in storage bins in locked vehicles or in a secured (locked) area of the DEQ Troy Information Center. All ABS samples collected from the OU7 properties, including QC samples, will be regularly transferred to the ESAT Laboratory Coordinator. The ESAT Laboratory Coordinator will provide Tetra Tech with a copy of the released CoC. The ESAT Laboratory Coordinator will transfer the samples to the on-site laboratory for preparation, the off-site laboratory for analysis, or to the storage archive.

4.2 PREPARATION AND ANALYSIS OF BACKGROUND SOIL SAMPLES

Background soil composites will be prepared for analysis in basic accord with SOP ESAT-LIBBY-01, Revision 0, *The Fluidized Bed Asbestos Segregator Method for Determination of Releasable Asbestos Fibers in Soil* (Appendix C).

Briefly, the composited background soil samples will be delivered to the Troy SPF where they will be dried and homogenized. Each sample will then be split in to three fractions. One fraction will be processed in basic accord with the current version of soil sample preparation SOP ISSI-LIBBY-01 and the fine fraction will be analyzed for asbestos by PLM-VE in basic accord with the current version of SOP SRC-LIBBY-03, *Analysis of Asbestos Fibers in Fine Soil by Polarized Light Microscopy* (the coarse fraction will be archived). A second fraction will be processed by FBAS and analyzed by TEM, and the third fraction will be archived.

4.2.1 Preparation of Fluidized Bed Filters

As noted above, an aliquot of each soil sample collected as part of this study will be used to prepare a FBAS filter for TEM analysis. The SPF will prepare one FBAS filter per soil sample in basic accord with SOP ESAT-LIBBY-01, Revision 0 (Appendix C) with the following exception. For 5 of the 20 soil samples, the FBAS aliquot will be used to prepare three replicate FBAS filters. The Troy SPF will generate three replicate FBAS filters (with one set of replicate filters sent to three different labs). The sampling party will provide to the Troy SPF the list of soil samples selected for triplicate FBAS filter preparation.

In addition, the SPF will make a determination as to whether the soil sample is rich in rock flour and relay this information to the analytical laboratory. In a 2011 report titled *Controlling Matrix Interference Effects of Rock Flour in the Fluidized Bed Method for Analysis of Asbestos in Soil* (ESAT 2011), ESAT recommends that soil samples prepared by FBAS for TEM analysis that are rich in rock flour should undergo indirect preparation with ashing in order to control matrix interference effects of the rock flour during TEM analysis.

The rock flour rich soil samples should undergo indirect preparation with ashing at the analytical laboratory in basic accord with SOP EPA-LIBBY-08 (EPA 2007), *Indirect Preparation of Air and Dust Samples for TEM Analysis*, and all applicable modifications described in the ESAT report (ESAT 2011).

4.2.2 Analysis of Fluidized Bed Filters

The following paragraphs present a summary of analytical method and stopping/recording rules for TEM analysis of the fluidized bed filters.

Analytical Method

Each fluidized bed filter shall be submitted for asbestos analysis using TEM in basic accord with the International Organization for Standardization (ISO) 10312 method (ISO 1995) counting protocols, and the most current version of the following project-specific laboratory modifications: LB-000016, LB-000029, LB-000067, and LB-000085, as well as laboratory modification LB-000066C (Although a more recent version is available for this laboratory modification [i.e., LB-000066D], this study intentionally has elected to utilize an earlier version to ensure a higher frequency of structure photographic images.).

TEM Stopping and Recording Rules

All amphibole structures (including not only LA but all other asbestos types as well) that have appropriate Selective Area Electron Diffraction (SAED) patterns and Energy Dispersive X-Ray Analysis (EDXA) spectra, and meet the specified recording rules (see below), will be recorded on the project-specific TEM laboratory bench sheets and in electronic data deliverables (EDD) developed for fluidized bed data recording and electronic submittals.

Background Soil Sample Initial Analysis (High Magnification)

Initially, the TEM microscopist will utilize a magnification of 20,000x. The microscopist will record the size (length and width, aspect ratio), structure type, and the mineral type for all structures longer than 0.5 micrometer (μm) with an aspect ratio of 3:1 or higher. For each filter, count a minimum of two grid openings on each of two grids. Analysis will continue until one of the following occurs:

1. A target analytical sensitivity for fluidized bed filters of 6.3E+03 gram^{-1} (g^{-1}) is achieved.
2. 50 LA structures are recorded.
3. An area of 1.2 mm^2 of filter has been examined.

(Note: These stopping rules may be revised during the study as data are accumulated.)

When one of these criteria is achieved, the analyst is to complete the grid opening being examined, and stop.

Supplemental Analysis (Low Magnification)

After completing the initial examination at 20,000x magnification, if fewer than 50 LA structures have been recorded, and the target sensitivity has not been achieved, the TEM microscopist will switch to a lower magnification of 5,000x and continue to record only PCME structures (i.e., length > 5 µm, width ≥ 0.25 µm, aspect ratio ≥ 3:1) until one of the following is achieved:

1. The target analytical sensitivity for fluidized bed filters (6.3E+03 g^{-1}) is achieved.
2. 50 LA structures are recorded (including the LA structures counted at high magnification).
3. An area of 3.0 mm^2 of filter has been examined (including the filter area counted at high magnification).

When one of these criteria is achieved, the analyst is to complete the grid opening being examined, and stop.

4.3 LABORATORY QUALITY CONTROL SAMPLES

4.3.1 Fluidized Bed Asbestos Segregator QC Samples

Filter Lot Blank. A filter lot blank is a filter cassette which has been taken from a new box of filter cassettes. Lot blanks are collected to ensure that sample filter cassettes do not have any asbestos contamination prior to their use. One blank per lot (500 cassettes) will be analyzed at the beginning of the study. In accordance with the FBAS SOP (Appendix C), the stopping for filter lot blanks will be to examine a filter area of 0.1 mm^2 (about 10 grid openings).

Sieve Duplicate. The FBAS fraction of each soil sample is split using the riffle splitter to produce parent and duplicate fractions, and both parent and duplicate are sent through the remainder of the preparation and analytical process as separate samples. Each is independently sieved and processed by the FBAS onto its own MCE filter. Sieve duplicates will be performed at a rate of one per 20 field samples or preparation batch, whichever is higher. The stopping rules for sieve duplicates are the same as those for the parent sample,

Preparation Blank. A preparation blank is a filter that is left uncovered on the bench top during processing of the soil samples with the FBAS. It is a measure of general laboratory cleanliness. One preparation blank will be prepared for each day the FBAS is operated. If more than one analytical batch is processed in a given day, a separate preparation blank will be prepared for each batch. In accordance with the FBAS SOP (Appendix C), the stopping rule for preparation blanks will be to examine a filter area of 0.1 mm^2.

Sieve (Sand) Blank. A sieve blank is made up of 50 grams of clean 20/30 quartz sand which is taken through the entire FBAS preparation process for the purpose of monitoring the cleanliness of the preparation lab and process and determining whether decontamination procedures are adequate. Sieve blanks should be analyzed at a rate of one per 20 field samples or one per preparation batch, whichever is higher. In accordance with the FBAS SOP (Appendix C), the stopping rule for sieve blanks will be to examine a filter area of 0.25 mm^2.

4.3.2 TEM Laboratory QC Samples

Laboratory Blank. A laboratory blank for TEM is a grid that is prepared from a new, un-used filter by the laboratory and is analyzed by TEM using the same procedure as used for field samples. The purpose of the laboratory blank is to determine if there are any significant sources of contamination arising during filter preparation and analysis in the TEM laboratory. One laboratory blank will be analyzed at a frequency of 4 percent.

Recounts. Recount analyses includes recount same, recount different, verified analyses, and inter-laboratory analyses. In all cases, the recount is a re-examination of the original TEM grid openings that were evaluated during the initial analysis. The purpose of recounts is to provide information on the reproducibility of the analytical results, both within and between analysts of the same laboratory, and between analysts from different laboratories (see current version of laboratory modification LB-000029 for additional details). Recount same analyses should be performed at a frequency of 1 percent, recount different analyses should be performed at a rate of 2.5 percent, inter-laboratory analyses should be performed at a frequency of 0.5 percent, and verified analyses should be performed at a frequency of 1 percent.

Repreparations. A repreparation by TEM is a grid that is prepared from a new aliquot of the same filter as was used to prepare the original grid. The purpose of repreparations is to provide information on the degree of inherent variability in preparation and analysis methods. Repreparations should be performed at a frequency of 1 percent (1 per 100 samples).

4.3.3 PLM Laboratory QC Samples

Laboratory Duplicates. Reanalysis of a sample by the same analyst, referred to as laboratory duplicate – self-check (LDS). LDS are performed by the same analyst as remount of the sample. All five slide mounts of the remounted sample should be analyzed by the original analyst. LDSs should be done at a frequency of 2 percent (2 per 100 samples).

Laboratory Replicates. Reanalysis of a sample by a different analyst, referred to as laboratory duplicate - cross-check (LDC). LDC are performed by a different analyst on the five original slide preparations at a frequency of 8 percent (8 per 100 samples).

Inter-laboratory Analyses. Inter-laboratory analyses are done to help detect and minimize laboratory bias and unnecessary variance in results, as well as to characterize precision across PLM-VE laboratories. Inter-laboratory analyses are to be done at a frequency of 1 percent (1 per 100 samples) on a quarterly basis. See SOP SRC-LIBBY-03 (Appendix C) for additional detail.

4.4 BACKGROUND SOIL DATA MANAGEMENT

4.4.1 Field

Original FSDSs and field logbooks will be maintained in the DEQ Troy Information Center office in Troy, Montana. When requested, scanned copies of FSDSs and field logbooks will be provided to EPA.

4.4.2 Fluidized Bed Processing Laboratory

The fluidized bed processing laboratory will record sample processing details in the appropriate log sheets (provided as attachments to SOP ESAT-LIBBY-01 [Appendix C]). Hard copies of all sample processing data sheets will be provided to EPA following completion of sample processing.

4.4.3 TEM/PLM Analytical Laboratory

The TEM/PLM analytical laboratory will use the Libby-specific EDDs developed for fluidized bed TEM and PLM analysis for data recording and electronic submittals. Scanned copies of all original bench sheets will be provided to EPA as part of the laboratory job report. Electronic spreadsheets should be transmitted to EPA by email.

4.5 BACKGROUND SOIL ABS STUDY DESIGN

The following sections summarize the proposed sampling design for the background soil ABS sampling scenario.

4.5.1 Sampling Locations

In 2010, EPA did a pilot study (EPA 2010) to provide an initial characterization of the range and distribution of background levels of LA and potentially other forms of asbestos in Libby Valley soils. Twenty candidate background locations in 11 different background areas (A-K) were sampled. The background study in OU7 uses a similar protocol to evaluate 10 background stations representatively located throughout the Troy Valley. The OU7 background soil ABS study will be completed after the background soil sampling using soil obtained from the identical background soil sampling locations.

4.5.2 ABS Design

Because it is most feasible to implement, performing outdoor ABS at a standardized location using soils from each background area will be performed as a preferred ABS design.

Enough soil will be obtained from each background study sampling location to fill a 5-gallon container (see Section 4.1.4). This container will be brought to a standardized location where ABS will be implemented. The standardized location will be established inside a 20- by 20-foot prefabricated storage shed with polyethylene sheeting on the walls and floors. The ABS scenario will be completed on a clean tarp or plastic sheeting to eliminate the potential for cross-contamination. Interior walls will be wet wiped with disposable paper towels between each sampling scenario. Two background air samples will be collected inside the storage shed prior to ABS activities to document baseline airborne asbestos levels.

The soil-disturbance activity will be a digging scenario that simulates a child digging and playing in the dirt. ABS personnel will sit on the ground and empty the soil from the 5-gallon container onto the polyethylene floor sheeting. They will use a hand trowel to place the soil back into the container. Once all the soil has been placed back into the container, the process will be repeated. Personnel will continue to dump and fill for 120 minutes.

4.5.3 Collection of Background Soil for Use in ABS

If LA is present in background soil, levels within each area could vary spatially. To ensure a more reliable estimate of the mean LA level in the soil and ABS air from each background soil location, soil will be collected from multiple sub-locations across each background area (See Section 4.1.4 Collection of Background Soil Samples). Enough soil material will be obtained from each of the 10 background soil sampling areas to fill a 5-gallon container.

Prior to collecting soil material, the top 1 inch of soil and any vegetation should be carefully removed and set aside. Soil materials should be collected from a depth of 1-6 inches. After soil collection, the top layer of soil and any vegetation should be replaced.

Prior to use in ABS, any soil clumps should be broken apart by hand and the soil should be well-mixed inside the container.

After the soil from the 5-gallon container has been emptied onto the polyethylene floor sheeting, a single grab soil sample (approximately 200 grams) will be collected for each ABS sampling. Because the soil material will be thoroughly mixed and homogenized prior to use in ABS, this grab sample will provide an estimate of the average level of LA in soil. At the time of collection, the amount of visible vermiculite (none, low, intermediate, high) will be recorded.

4.5.4 Number of ABS Air Samples

Because it is not currently possible to quantify the uncertainty in the mean of an asbestos dataset as a function of the number of samples, it is not possible to calculate a minimum number of samples required to minimize decision errors. The uncertainty around the mean depends on sample size and on the underlying variability.

No information is available on the expected variability in LA levels in background soil. Initially, one ABS sampling will be completed for each background soil collection area. The need for additional sampling will depend on the variability of LA concentrations in ABS air samples across OU7.

4.5.5 ABS Air Sample Collection

During each sampling, each ABS person will wear two different sampling pumps—a high volume pump and a low volume pump—to collect two "replicate" filters (i.e., each filter represents the same sample collection duration, but different total sample air volumes). The appropriate flow rate for each sampling pump will be optimized to achieve the highest sample air volume possible without causing the filter to become overloaded. Initially, the high volume pump flow rate will be 10.0 liters per minute (L/min) and the low volume pump flow rate will be 4.0 L/min. This will result in sample volumes of 1,200 L and 480 L. The high volume air sample will be collected using an electrically operated sampling pump while the lower volume air samples will be collected using a battery-powered sampling pump capable of operating for an extended period at 4.0 L/min. The specific models selected for this project are the Gilair high volume air sampling pump and the SKC AirChek 5000 personal air sampling pump. Only one of the two air samples will be selected for analysis and the remaining sample will be archived.

ABS air sampling will occur over a 2-hour period for each of ten 5-gallon buckets of background soil collected. ABS air samples will be collected by actors performing activities in accordance with the scenario described in Section 4.5.2. For each 5-gallon bucket, one actor will engage in the prescribed activity. Only one activity will be collected at a time. All ABS air samples will be collected using cassettes that contain a 25-millimeter diameter mixed cellulose ester (MCE) filter with an 0.8 µm pore size.

The monitoring cassette will be affixed to the chest of the actor performing the child play activities so that the cassette is in the proper breathing zone of a child. The breathing zone can be visualized as a hemisphere approximately 8 to 12 inches around an individual's face. The top cover from the cowl extension on the sampling cassette will be removed (i.e., open-face) and the cassette will be oriented face down. The actors will monitor the cassette throughout the scenario to ensure it remains directed toward the activity and is free of obstructions. If it is necessary to relieve an actor in a scenario, a relief actor will be properly suited in time to make the exchange. When the relief actor is ready, the active actor will stop, remove the sample pump, pass it to the relief actor, and assist with donning and adjusting the sample pump and cassette placement. The exchange is anticipated to take less than 60 seconds, so the sampling pumps and event time clock will not be halted during the exchange. If the exchange takes more than 60 seconds, the pump and event clock will be stopped until the activity is re-initiated. If the personnel exchange coincides with scheduled flow rate verification, the total exchange time must not exceed 120 seconds.

4.5.6 Pump Calibration

Each air sampling pump will be calibrated at the start of each day's sampling period using a primary calibration source. The primary calibration standard used is a Bios DryCal® DC-Lite. Calibration will be considered complete when plus or minus (±) 5 percent of the desired flow rate is attained, as determined by three measurements with the calibrator using a cassette reserved for calibration (from the same lot of the sample cassettes to be used in the field). Pump flow rates will be verified at 60-minute intervals or when actors are relieved from an activity by a backup actor. Field calibrations, taken between the pre- and post-calibrations, may be taken using a rotometer that has been calibrated using a primary calibration source. If at any time the observed flow rates are ±10 percent of the target rate, the sampling pump should be re-calibrated, if possible. If at any time an air sampling pump is found to have faulted or the observed flow rates are 25 percent below (due to heavy particulate loading or a pump malfunction) or 50 percent above the target rate, the pump will be replaced or the activity will be terminated. Collection of air samples will continue, regardless of the amount of particulate loading on the filters, unless the flow rate is affected.

At the beginning of the sampling program, flow rates and particulate loading may be checked more frequently as conditions require, establishing expected conditions. For post-sampling calibration, three separate constant flow calibration readings will be obtained using the Bios DryCal® DC-Lite primary calibration source. The sampling cassette will remain inline during calibration and those flow readings will be averaged. If the flow rate changes by more than 5 percent during the sampling period, the average of the pre- and post-sampling rates will be used to calculate the total sample volume. Samples with more than a 30 percent difference from initial calibration to end calibration will be invalidated. For invalidated samples the sample collector will record the pump serial number, sample number, initial flow rate, sample start and end times, sample locations, and final flow rate, and will mark the sample "void," in the field logbook and OU7 Background Soil/ABS form. The invalidated samples will not be submitted for analysis and will be properly disposed of. The activity scenario will be completed a second time and the air sample will be recollected. To prevent potential cross-contamination, each rotometer used for field calibration will be transported to and from each sampling location in a sealed zip-lock plastic bag. The cap and calibration cassette used at the end of the rotometer tubing will be replaced each morning after it is used.

4.5.7 Equipment and Personnel Decontamination

Air monitoring pumps, tubing and calibration equipment will be wet wiped with moistened, disposable, paper towels before and after each ABS sampling. Personnel decontamination procedures, including requirements for decontamination zones, are described in Section 10.1 of the HASP (Appendix A). PPE will consist of disposable gloves, disposable protective outerwear, work boots, disposable boot covers, and respirators. The respirators will be cleaned and decontaminated as discussed in Section 10.2.1 of the ABS HASP (Appendix A).

4.5.8 Investigation-Derived Waste

IDW will include used wet wipes, paper towels, disposable gloves, used respirator cartridges, used plastic tubing, disposable protective outerwear, plastic coverings, and other minimal waste. Because it is possible, but not likely, that this IDW may contain some asbestos, all IDW will be double-bagged in appropriate asbestos bags, labeled with asbestos labels, and stored in an approved containment area at the DEQ Troy Information Center until it can be properly disposed of at an approved landfill. Non-sampling waste from the ABS field teams, such as food containers and waste paper, will be separately bagged and properly disposed of as solid waste.

4.6 FIELD QUALITY CONTROL SAMPLES

Field QC samples will be collected in association with air samples and will include filter lot blanks and field blanks. These are described below and summarized in Table 4-2.

TABLE 4-2
FIELD QUALITY CONTROL SAMPLES

Sample Media Type	QC Sample Type	Collection Frequency	Analysis Frequency	Analysis Request	Acceptance Criteria
Air	Filter Lot Blank	1 per case (50 cassettes)	100%	TEM	ND for all asbestos fibers
Air	Field Blank	1 per day of sampling	100%	TEM	ND for all asbestos fibers

Notes:

% Percent
QC Quality control
TEM Transmission Electron Microscopy
ND Non detect

4.6.1 Filter Lot Blanks (Air)

Before any air sampling cassette is used, a cassette from each filter lot will be randomly selected and submitted for analysis. The filter lot blanks will be analyzed for asbestos fibers by the same method used for field sample analysis. The entire batch of cassettes will be rejected if any asbestos fiber is detected on a lot blank.

4.6.2 Field Blanks (Air)

One field air blank will be collected each day for the duration of this sampling program. The field blanks will be analyzed for asbestos fibers by the same TEM method used for field sample analysis. The field blanks will be collected by opening the sample cassette package and exposing the cassette to the full range of field efforts including sample handling, car travel, attaching to the air sample pump for ten seconds (not turned on), retrieving the sample cassette, returning to the office, packaging, and transporting to the laboratory.

4.6.3 Health and Safety Air Monitoring

As part of this investigation, personal air samples will be collected on the first day of sampling for ongoing health and safety monitoring. The health and safety samples will be collected using an additional low volume sampling pump and are not intended for use in the ABS sampling or with the risk assessment. To differentiate these samples from the other air samples, PCM will be used in the Sample Location Description field of the OU7 Worker and Work Zone Sampler Summary form. These samples will be collected and analyzed in accordance with the 2012 OU7 HASP and will represent the 8-hour TWA and 30-minute STEL for each employee work category. The PEL is 0.1 f/cc for the 8-hour TWA, and the STEL is 1.0 f/cc over 30 minutes as specified in 29 CFR Part 1910.1001 (j)(2)(iii).

4.7 BACKGROUND SOIL ABS DOCUMENTATION

Logbooks and field forms will be completed for each soil sample bucket ABS procedure. Sample information and visual inspection results will be recorded in the logbook.

4.7.1 Recordkeeping and Chain-of-Custody

At the end of each day, or more often if required, the ABS field teams will return to the DEQ Troy Information Center to download and transfer data recorded on the OU7 Background Soil/ ABS field forms. The field teams will transfer the air samples and any QC samples, provide copies of the appropriate logbook pages to the Tetra Tech Sample Coordinator (or the coordinator’s designee) and download digital photographs. Photographs will be electronically labeled and entered into the OU7 MARCH database. MARCH is a Microsoft Access database used to manage electronic documents and associated metadata in accordance with EPA Appendix C requirements (EPA 2012b). Individual photographs will not be routinely printed. Data from the field forms will be downloaded or entered on a daily basis into a local field Scribe database. Once all data have been processed, the Scribe project will be informally published to Scribe.NET. The field database will be incorporated into the primary OU7 Scribe database, LibbyTTOU7Field, and will be formally published to Scribe.NET.

An individual file (paper and electronic) will be maintained for each background soil ABS scenario. Originals of all field forms will be kept in each individual property file in the DEQ Troy Information Center for the duration of the project. Scanned Portable Document Format

(PDF) copies of all field forms and appropriate logbook pages, and digital photographs will be stored in each individual electronic property file. A backup electronic copy of the files will be stored away from the DEQ Troy Information Center, and will be updated periodically for the duration of the sampling, and reporting phases of the project. Copies of all QA/QC records, forms, and field logbooks will be available to DEQ, EPA, or to the Troy property owners at any time during the ABS project.

After the OU7 Background Soil/ABS form electronic information and data are entered in the local field Scribe database, the field sample coordinator will check all sample ID numbers for accuracy. The field sample coordinator will print a hard copy of the CoC form and store these records with the associated samples. The CoC report will be transferred to the ESAT) Laboratory Coordinator.

Until samples have been transferred to the ESAT Laboratory Coordinator, they will be securely held by Tetra Tech. Samples may be stored in storage bins in locked vehicles or in a secured (locked) area of the DEQ Troy Information Center. All ABS samples collected from the OU7 properties, including QC samples, will be regularly transferred to the ESAT Laboratory Coordinator. The ESAT Laboratory Coordinator will provide Tetra Tech with a copy of the released CoC. The ESAT Laboratory Coordinator will transfer the samples to the on-site laboratory for preparation, the off-site laboratory for analysis, or to the storage archive.

4.7.2 Field Logbooks

Documentation of field activities will be recorded in field logbooks maintained specifically for this sampling program. Logbooks are controlled documentation (i.e., sequentially numbered) and maintained by DEQ and EPA.

The logbook is an accounting of activities at the site and will note problems or deviations from the governing plans and observations relating to the sampling and analysis program. A new logbook page will be completed for each background soil ABS scenario. The header information will include the address, and the property owner's name. When closing out a logbook page with lineout and signature, the author will print their name underneath the signature. Original logbooks will be maintained in the DEQ Troy Information Center.

4.7.3 Sample Labeling and Identification

A unique alphanumeric code, or sample ID number, will identify each sample. The coding system will provide a tracking record to allow retrieval of information about a particular sample and to ensure that each sample is uniquely identified. Sample IDs will be sequential and not be representative of any particular ABS scenario. Sample IDs will correlate with sample location IDs that will be identified in the field logbooks.

The sample labeling scheme will follow the format:

TK-XXXXX

where:

TK identifies that a sample is collected in accordance with this soil background study SAP/QAPP and XXXXX represents a 5-digit numeric code.

Preprinted adhesive sample labels will be signed out to sampling personnel by the sample database manager. The labels are controlled to prevent duplication in assigning sample IDs. The labels will be affixed to the inner and outer sample bags for ABS air samples.

4.7.4 Photographic Documentation

Photographs will be taken with a digital camera at sampling locations and during each sampling. Photos will generally include close up shots of soil materials, equipment, actors, and any other notable photos to support later health risk assessments that the sampler might identify. A description of each photograph will be recorded in the field logbook in accordance with photographic log protocol (Appendix I of TAPE work plan [Tetra Tech 2007]). A list of photographs in the field logbook will clearly state where each photograph was taken (e.g., background soil ABS scenario). Electronic photograph files will be saved each day to a project-designated computer at the DEQ Troy Information Center and assigned appropriate metadata in MARCH so that photographs for a particular ABS property or scenario can easily be retrieved.

4.8 Background Soil Activity-Based Air Sample Analysis

The following sections present the analytical method, recording, and stopping rules for ABS air sample analysis.

Analytical Method

ABS air samples collected as part of this effort will be prepared and analyzed for LA using TEM in accordance with ISO 10312 (ISO 1995), modified in accordance with the current version project-specific laboratory modifications LB-000016, LB-000029, LB-000067, and LB-000085, as well as LB-000066C. (Although a more recent version is available for this laboratory modification [i.e., LB-000066D], this study intentionally has elected to utilize an earlier version to ensure a higher frequency of structure photographic images.)

Detailed information on the analytical requirements and stopping rules are provided below.

TEM Stopping and Recording Rules

All amphibole structures (including not only LA but all other asbestos types as well) that have appropriate Selective Area Electron Diffraction (SAED) patterns and Energy Dispersive X-Ray Analysis (EDXA) spectra, and meet the specified recording rules (see below), will be recorded on the project-specific TEM laboratory bench sheets and EDD.

Stopping Rules

Three alternative stopping rules are specified to ensure that the ABS air data meet data quality objectives without being unnecessarily costly or time intensive. These are as follows:

1. The specified target analytical sensitivity has been achieved, or
2. The specified maximum number of structures have been recorded, or
3. The specified maximum area of the filter has been examined.

The specific values associated with these alternative rules and the basis for each are presented below.

Target Analytical Sensitivity

In order to be comparable to residential outdoor ABS data collected at OU7 properties, the target analytical sensitivity for soil ABS air data collected at background areas was calculated based on residential exposure parameters. The exposure parameters needed to calculate TWF are not known with certainty, so the following reasonable maximum exposure (RME) exposure parameters were selected based on information in EPA's *Exposure Factors Handbook* (EPA 1997) and on professional judgment:

- The exposure time (ET) parameter of 8 hours was based on the RME value of 7.8 hours per day (from Table 15-92 in EPA 1997) for time spent doing yard work.
- Site-specific data on the frequency of outdoor yard care activities were not located, but EPA (1992) recommends assuming about 1-2 days per week during warm weather. In Troy, assuming outdoor yard work is likely to occur mainly between May and September (about 20 weeks per year), the RME exposure frequency (EF) parameter for the number of days per year spent doing yard work was estimated to be about 40 days.
- At present, no site-specific data exist that provide information on the exposure duration (ED) of area residents. In the absence of data, a conservative value of 50 years was assumed.

- For cancer-based calculations an averaging time (AT) of 70 years was used. For noncancer-based calculations, an AT value of 60 years was used, consistent with similar Libby (OU4) calculations.

Based on these exposure parameters, the cancer-based TWF (TWF_{cancer}) is 0.0261 (8/24 · 40/365 · 50/70 = 0.0261); the noncancer-based TWF ($TWF_{noncancer}$) is 0.0304 (8/24 · 40/365 · 50/60 = 0.0304). Based on these values, the RBC for cancer is 0.0023 LA PCME s/cc and the RBC for non-cancer is 0.00066 LA PCME s/cc. Because the non-cancer RBC is lower than the cancer RBC, the non-cancer RBC is used to derive the target analytical sensitivity.

As stated in CDM Smith (2012), the target analytical sensitivity can be calculated as follows:

Target Analytical Sensitivity = RBC/Target Count

The target count in this case is determined as a minimum detection frequency required for samples at the RBC. A minimum detection frequency of 95 percent equates to a target count of 3 structures following the methodology described in CDM Smith (2012). Therefore, the target analytical sensitivity for ABS air samples for this study is 0.00022 cc^{-1}.

Maximum Number of LA Structures

Above about 25 structures, there is little change in the relative uncertainty as a consequence of Poisson variability. Therefore, the count-based stopping rule for TEM analysis of ABS air samples is 25 LA structures.

Maximum Area to be Examined

Assuming that the high volume filter is able to be prepared directly (i.e., F-factor = 1), about 146 grid openings would need to be examined for each ABS air sample to achieve the target analytical sensitivity. If the low volume filter is able to be prepared directly, about 365 grid openings will need to be examined.

In order to limit the effort expended on any one sample in the event that an indirect preparation is necessary, a maximum area examined of 20 mm^2 is identified for this sampling program. Assuming that each grid opening has an area of about 0.01 mm^2, this would correspond to about 2,000 grid openings.

Summary of TEM Stopping Rules

The TEM stopping rules for ABS air samples in this study will be as follows:

1. Examine a minimum of two grid openings from each of two grids.

2. Continue examining grid openings until one of the following is achieved:

a. The target analytical sensitivity ($0.00022\ cc^{-1}$) is achieved.

b. 25 PCME LA structures have been recorded.

c. A total filter area of 20 mm^2 has been examined (this is approximately 2,000 grid openings).

When one of these criteria has been achieved, the analyst should complete the examination of the grid opening that was under examination, and then stop.

5.0 DATA MANAGEMENT

Data management will be under the supervision of the Tetra Tech Database Manager in the DEQ Troy Information Center. Field crews will generate field data on paper copies and digital photographs. All field data will be managed according to EPA reporting requirements specified in the EPA Data Management Plan (EPA 2012b).

These reporting requirements were developed to help satisfy EPA's removal objectives at the Libby Asbestos Superfund Site. The reporting requirements guide data collection processes and data reporting procedures for spatial information, tabular data, and documents (EPA 2012b).

5.1 TABULAR DATA

The Tetra Tech Database Manager will be required to format and submit all tabular data in accordance with EPA reporting requirements (EPA 2012b). Operational electronic data will be QC reviewed, entered into a local field Scribe database, and informally published to Scribe.Net within one day of data collection; and, after data auditor checks, formally published to Scribe.NET as part of the primary OU7 Scribe database, LibbyTTOU7Field. This will ensure that EPA has consistent and up-to-date information.

5.2 DOCUMENTS AND RECORDS

The Tetra Tech Database Manager will be required to format and submit all operations documents and records in accordance with EPA reporting requirements (EPA 2012b). Hard copy documents will be stored in file cabinets at the DEQ Troy Information Center. Electronic copies will be barcoded and assigned the appropriate metadata in the MARCH database. When requested, these records and associated metadata will be delivered to EPA.

6.0 QA/QC PROCEDURES

The QA/QC objectives, internal QC checks, and audits completed for the project are described in this section. Field QC control procedures are described in Sections 4.3 and 4.6.

6.1 QA/QC OBJECTIVES

The QA/QC objectives of the background soil study are to obtain 100 percent usable and accurate data. This will be achieved through inspection and sampling using standardized PDA data entry procedures, auditing field operations, observing COC procedures, analyzing field and laboratory QC samples, and field and analytical data review, verification, and validation. The DQOs are described in detail in Section 3.0.

6.2 DATA VERIFICATION AND VALIDATION

6.2.1 Field and Analytical Data Verification

Tetra Tech will conduct verification of the field and analytical data generated under this SAP/QAPP. Laboratory QC data will undergo the validation process described in Section 6.2.2.

Data verification includes checking that results have been transferred correctly from the original hand-written field and analytical laboratory documentation to the project database. The goal of data verification is to identify and correct data reporting errors. Verification of reported analytical results begins with automated QC checks that are built into the project-specific EDDs.

In addition to these automated checks, more detailed manual data verification efforts will be performed for 10 to 25 percent of the analytical results (100 percent of the field QC data) uploaded to the project database. This data verification process utilizes project-specific SOPs EPA-LIBBY-09, *TEM Data Review and Data Entry Verification,* EPA-LIBBY-10, *Standard Operating procedure for PLM Data Review and Data Entry Verification,* and EPA-LIBBY-11, *FSDS Data Review and Data Entry Verification* , developed to ensure analytical data and field sample information in the project database are accurate and reliable. If issues are identified during the data verification, the frequency of verification may be increased as appropriate.

Tetra Tech's QA Manager will document issues identified on a verification tracking spreadsheet, which will be provided to ESAT for resolution. It is the responsibility of the Tetra Tech Database Manager to coordinate with the Tetra Tech Field Team Leader and/or QA Manager to resolve any project database corrections and address any recommended field or laboratory procedural changes from the verification process. The Tetra Tech Database Manager is also responsible for electronically tracking in the project database which data have been verified and who performed the verification.

6.2.2 Data Validation

Unlike data verification, where the goal is to identify and correct data reporting errors, the goal of data validation is to evaluate overall data quality and to assign data qualifiers, as appropriate, to alert data users to any potential data quality issues. Data validation will be performed by the QATS contractor, with support from technical support staff that are familiar with project-specific data reporting, analytical methods, and investigation requirements.

Data validation will be performed in basic accordance with the *National Functional Guidelines for Asbestos Data Review* (EPA 2011) and the site-wide QARD (USACE 2012) and should include an assessment of the following:

- Internal and external field audit/surveillance reports
- Field ROMs
- Field QC sample results
- Internal and external laboratory audit reports
- Laboratory contamination monitoring results
- Laboratory ROMs
- Internal laboratory QC analysis results
- Inter-laboratory analysis results
- Performance evaluation results
- Instrument checks and calibration results
- Data verification results (i.e., in the event the verification effort identifies a larger data quality issue)

6.3 DATA QUALITY EVALUATION

The DQOs in Section 3 will be reconciled during the data verification process. This entails comparing the reported results to the project-specific action levels in Section 3. Attainment of project-specific DQOs is necessary to accurately determine HHRA goals including: (1) determining if acceptable risk to human health exists for parcels where interim exterior removals were not required, and (2) determining if the interim exterior removals were effective in reducing the threat to human health from exposure to LA. Non-attainment of project DQOs may result in potential risks to human health.

6.4 AUDITS, CORRECTIVE ACTIONS, AND QA REPORTS

Field audits will be an integral part of Tetra Tech's field operations for the duration of the project. Field audits and corrective actions will be the responsibility of DEQ, EPA and the Tetra Tech QA Manager. The field audit forms will be kept in the DEQ Troy Information Center for the duration of the project.

6.4.1 Field Inspections and Sampling Procedures Audits

The Tetra Tech QA Manager will be responsible for audits of field activities and sampling procedures. Audits will be done every two weeks. Audits will consist of the QA Manager or his designee attending a sampling event and observing the field teams' activities. The field teams will not be warned of the audit. The auditor will compare the field teams' activities with the protocols in this SAP/QAPP and the attached project-specific guidance and evaluate compliance with the protocols using the audit form in Appendix C. After the audit, the auditor will provide the completed audit form to the DEQ and EPA project managers.

6.4.2 Corrective Action Procedures

The auditor may use their discretion to provide immediate verbal feedback to the field team, to ensure that discrepancies are corrected as quickly as possible. The Field Team Leader and QA Manager will review the report with the field team within 48 hours of the audit to correct any deviations or deficiencies. If any deviations or deficiencies were noted, the field team will be audited again within one week of the original audit to ensure that any deficiencies have been corrected. If a field team member is rotated off the project after deviations or deficiencies were noted, the field team members will be audited again within one week of returning to Troy.

If gross deficiencies are noted, the Tetra Tech QA Manager will determine whether any additional activities are required. Re-sampling will be required only if the field team failed to correctly complete the background soil study, or collected samples incorrectly.

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APPENDIX A

TETRA TECH
SITE-SPECIFIC HEALTH AND SAFETY PLAN
OU7 ACTIVITY-BASED SAMPLING

(Available to Agencies upon Request)

APPENDIX B

FIELD FORMS

OU7 BACKGROUND STUDY ACTIVITY-BASED SAMPLING FORM
GROUND COVER / SOIL DATA

Tetra Tech EM, Inc.
Background Study (ABS)

Date:________________________

ABS Category (check one):	☐ Background	☐ Other
Background Location:	Location Name:	Lat/Long:
Collected By:		

Sample #	**Ground Cover** [1]	**Soil Moisture Content VWC%** [2]	**Soil Texture** [3]

NOTES: GPS coordinates should be collected to depict the center of background location included in the ABS

1) Ground Cover
Note: multiple designations may be used, follow letter with percentage:
ex: A75 B25
a) Grass
b) Bare Soil
c) Gravel / Rock
d) Duff/other vegetative debris
d) Miscellaneous vegetative cover

2) Soil Moisture Content
Moisture readings will be taken with a Volumetric Water Content (VWC) meter from a minimum of 10 locations between 0 to 3 inch soil depth

3) Soil Texture
Soil texture will be record using visual and hand texture testing.
Recording options include:
a) Clayey
b) Silty
c) Sandy
d) Loamy
e) Gravelly

OU7 BACKGROUND STUDY ACTIVITY-BASED SAMPLING FORM (continued)
AIR SAMPLING DATA

Tetra Tech EM, Inc.
Background Study (ABS)

Date:______________________

Cassette Lot No:___________

ABS Category (check one):	☐ Background	☐ Other
Background Location:	Location Name:	
Collected By:		

Sample #	Pump I.D.#	Rotometer I.D. #	Sample Type [4]	ABS Scenario[5]	Time On / Time Off / Total Minutes	Flow Rate-Start / Flow Rate-Stop / Total Volume (Liters)	ABS Background Location/Size (square feet)[6]	Personnel Sampled	ABS Activity[7]	Receptor[8]
			FS	Background Soils	/ / 	/ / 	600		Digging	Child
					/ / 	/ / 				
					/ / 	/ / 				
					/ / 	/ / 				
					/ / 	/ / 				

NOTES: All ABS samples will be collected on 25 mm diameter mixed cellulose ester (MCE) filter cassettes with a pore size of 0.8µm

4) Sample Type
FS = Field Sample
FB = Field Blank
FD = Field Duplicate
EB = Equipment Blank
FP = Field Split
LB = Lot Blank

5) ABS Scenario
Background Soils (all)

6) ABS Background Location/Size
600 ft2 per sample (all)

7) ABS Activity
Digging (all)

8) Receptor: Child (all)

APPENDIX C

STANDARD OPERATING PROCEDURES

Site-Specific Sampling Guidance
Libby Superfund Site

Guidance No.: **CDM-LIBBY-05, Revision 3**

Guidance Title: **Soil Sample Collection at Residential and Commercial Properties**

Approved by:

Project Manager	Date
Technical Reviewer	Date
QA Reviewer	Date
EPA Approval	Date

Section 1
Purpose

The goal of this standard operating procedure (SOP) is to provide a consistent method for the collection of 30-point composite surface soil sampling to support all investigations conducted at the Libby Superfund Site and specified in governing guidance documents. This SOP describes the equipment and operations used for sampling surface soils in residential and commercial areas, which will be submitted for the analysis of Libby amphibole asbestos. Refer to each investigation-specific guidance documents or work plan for detailed modifications to this SOP, where applicable. The EPA Team Leader or their designate must approve deviations from the procedures outlined in this document prior to initiation of the sampling activity.

Section 2
Responsibilities

Successful execution of this SOP requires a clear hierarchy of assigned roles with different sets of responsibilities associated with each role. All staff with responsibility for the collection of soil samples is responsible for understanding and implementing the requirements contained herein as well as any other governing guidance documents.

<u>Task Leader (TL) or Field Team Leader (FTL) -</u> The TL or FTL is responsible for overseeing sample collection processes as described in EPA approved governing guidance documents (i.e., site-specific sampling and analysis plans [SAPs], quality assurance project plans [QAPPs], etc.). The TL or FTL is also responsible for checking all work performed and verifying that the work satisfies the specific tasks outlined by this SOP and all governing guidance documents. The TL or FTL will communicate with the field team members regarding the specific collection objectives and anticipated situations that require deviation from this SOP. It is also the responsibility of the TL or FTL to communicate the need for any deviations from the SOP with the appropriate EPA personnel (team leader or their designate), and document the deviations using a Field Modification Form provided in each SAP or QAPP.

<u>Field team members</u> - Field team members performing the sampling described in this SOP are responsible for adhering to the applicable tasks outlined in this procedure while collecting samples at properties associated with the Libby Superfund Site. The field team members should have limited discretion with regard to collection procedures but should exercise judgment regarding the exact location of sample points, within the boundaries outlined by the TL or FTL.

Section 3
Equipment

- Measuring tape or wheel – Used to estimate the square footage of each land use area.
- Pin flags – Used to identify composite points within each sampling area.
- Trowel or push probe - For collecting surface soil samples.
- Shovel - For collecting surface soil samples.
- Stainless steel mixing bowl - Used to mix and homogenize composite soil samples after collection. Zip-top bags may also be used for homogenization if approved by the governing guidance documents.
- Gloves - For personal protection and to prevent cross-contamination of samples (disposable, powderless plastic or latex).
- Sample container - Gallon-sized zip-top plastic bags (2 per sample).
- Field clothing and personal protective equipment (PPE) - As specified in the current version of the site health and safety plan (HASP).
- Field sprayers – Used to suppress dust during sample collection and to decontaminate nondisposable sampling equipment between samples.
- Deionized (DI) water- Used in field sprayers to suppress dust and to clean and decontaminate sampling equipment.
- Plastic bristle brush - Used to clean and decontaminate sampling equipment.
- Wipes - Disposable, paper. Used to clean and decontaminate sampling equipment.
- Aluminum foil – Used to wrap decontaminated sampling equipment in between uses to prevent contamination during transport.
- Alconox – Used to clean and decontaminate sampling equipment weekly.
- 6-mil poly bag – Used to store and dispose of investigation-derived waste (IDW).
- Trash bag - Used to store and dispose of general trash.
- Field logbook/PDA - Used to record progress of sampling effort and record any problems and field observations.

- Visual Vermiculite Estimation Form (VVEF) – Used to record semi-quantitative estimates of visual vermiculite at each sub-sample location and point inspection (PI).

- Permanent marking pen - Used to label sample containers.

- Sample ID Labels (Index IDs)– Pre-printed stickers used to label sample containers.

- Cooler or other rigid container - Used to store samples while in the field.

- Custody Seals - For ensuring integrity of samples while in the field and during shipping.

Section 4
Sampling Approach

Upon arrival at each property, the field team will locate all parcels requiring sample collection depending on the investigation-specific objectives detailed in governing guidance documents. Parcels on a property will be sectioned into zones that share a similar land use. Zones established by land use areas may be subdivided based on site conditions (e.g., access, construction setup considerations, etc.). Use areas include:

- Specific Use Area (SUA): flowerbed, garden, flowerpot, stockpile, play area, dog pen, driveway (non-paved), parking lot (non-paved), road (non-paved), alley (non-paved)

- Common Use Area (CUA): yard, former garden, former flowerbed, walkway

- Limited Use Area (LUA): pasture, maintained/mowed field, overgrown areas with trails/footpaths, overgrown areas in between SUAs/CUAs

- Interior Surface Area (ISA): soil floor of garage, pumphouse, shed, crawlspace, earthen basement

- Non-Use Areas(NUA): wooded lot, un-maintained field. NUAs will be identified but will not be sampled at this time because they are not presently considered a complete exposure pathway. However, to the extent that NUAs may become a complete exposure pathway in the future, EPA may revisit NUAs at a later date.

After areas have been designated as zones (i.e., SUA zones, CUA zones, LUA zones, NUA zones, ISA zones), the field team will measure the zones with a measuring wheel and label the zone type and approximate square footage on the field sketch and/or design drawings. There is not a minimum or maximum square footage restriction on any zone.

In establishing zones at the property, no area type may be combined with any other area type. For example, driveways and flowerbeds are both SUAs but will be separated into unique zones for soil sampling. Similarly, large CUAs such as yards may be subdivided into front yard, side yard, and back yard zones dependent on site conditions. Sectioning properties into additional zones will be at the discretion of the FTL but consistent among the teams. Conversely, not all land use areas previously mentioned will be applicable at every property.

It is anticipated that SUAs and ISA zones will generally tend to be smaller parcels. Combining small, proximal SUAs into one zone will be at the discretion of the FTL but consistent among teams. With the exception of proximal SUAs, all other land use areas will be contiguous when establishing zones at each property.

Composite sampling requires soil collection from multiple (sub-sample) points. Composite samples will be collected from similar land use areas (i.e., SUA, CUA, etc.) and will not be combined with any other use area. One composite sample will be collected from each zone.

For SUAs (e.g., driveway, garden, dog pen, etc.), composite samples will be collected from the 0- to 6–inch depth interval. If a depth of 6 in. cannot be attained given the varying levels of compaction in driveways, roads, etc. the maximum depth attainable will be documented in the field logbook/PDA. For non-SUAs (e.g., yard, former flowerbed, crawlspace, etc.), composite samples will be collected from 0 to 3 inches. All composite soil samples will have 30 sub-samples (i.e., 30-point composite sample) of approximately equal size for a final sample volume between 2,000 and 2,500 grams. Table 1 lists the sample depth for each type of land use area.

TABLE 1
SAMPLING AREA AND DEPTH

Land Use Area	Label	Sampling Depth (Inches)
Special Use Area	SUA	0 – 6
Common Use Areas	CUA	0 – 3
Limited Use Area	LUA	0 – 3
Non-Use Area	NUA	Not Sampled
Interior Surface Zone	IS	0 – 3

As each sub-sample is collected, the soil will be inspected for visual vermiculite (VV) and the location and semi-quantitative estimates of VV will be recorded as prescribed in the SOP for Semi-Quantitative Visual Estimation of Vermiculite in Soil, Revision 1 (CDM 2007a).

Areas of SUAs with VV will not be sampled. Instead, the location will be recorded in the field logbook/PDA and on the field sketch or design drawing. If the SUA is of substantial size (greater than 1000 square feet [ft^2]), and the VV is localized, additional PIs will be collected to determine the extent of VV and a sample will be collected from the remainder of the zone that does not contain VV. If the SUA measures less than 1,000 ft^2 and VV is present, a sample will not be collected from that SUA. Proximal SUAs will not be combined into a SUA zone if VV is present. If visible vermiculite is not observed, proceed with sample collection of the SUA zone

Section 5
Sample Collection

Don the appropriate PPE as specified in the governing HASP. A new pair of disposable gloves is to be worn for each sample collected. Segregate land use areas on the property into zones as described in Section 4. To reduce dust generation during sampling, use a sprayer with DI water to wet each sub-sample location prior to collection. Use the trowel to check beneath the surface soil layer, but do not advance more than 6 inches. If VV is observed, record the information on the field sketch or design drawing. If VV is observed within a large SUA, do not collect a sample from the area containing VV as described above.

Within each zone, select 30 sub-sample locations equidistant from each other. These 30 sub-sample locations will comprise the 30-point composite sample for that zone. All composite sub-samples will originate from the same land use area. For example, do not mix sub-samples from SUAs with sub-samples from LUAs.

Clean the sub-sample locations of twigs, leaves, and other vegetative material that can be easily removed by hand. Using the trowel or push probe, excavate a hole in the soil approximately 2 inches in diameter and 6 inches deep for SUAs, or 3 inches deep for non-SUAs, while placing the excavated material directly inside the gallon-sized zip-top plastic bag. Repeat this step for each subsequent sub-sample until the appropriate number of composite sub-samples has been collected. As each sub-sample is collected, inspect the location for VV as prescribed in the SOP for Semi-Quantitative Visual Estimation of Vermiculite in Soil, Revision 1 (CDM 2007a).

Samples collected from zones measuring greater than 3,000 ft^2 will require additional PIs to inspect the soil for VV, but no more than 30 sub-samples will be collected from a zone for each composite sample. Samples collected from zones measuring less than 3,000 ft^2 will have the same number of sub-samples as PIs unless additional PIs are required to identify the extent of localized VV.

Homogenize the sample as required by governing guidance documents. Once the sample is homogenized, fill the zip-top plastic bag to 1/3rd full (approximately 2000 grams). Affix the sample index ID label to the inside of the bag and write the index ID number on the outside of the bag, or affix an additional label using clear packing tape. Sample index ID numbers will be assigned based on the investigation-specific guidance document. Double bag the sample and repeat the labeling process for the outer bag. Decontaminate equipment between composite samples as described in Section 8.

Repeat steps outlined above until all samples from a property have been collected.

Soil field duplicate samples will be collected at the rate specified in governing guidance documents. Field duplicate samples will be collected as samples co-located in the same zone. The duplicate will be collected from the same number of sub-samples as the parent sample, but the sub-sample locations of the duplicate sample will be randomly located in the zone. The inspection for VV at each sub-sample location will follow the same protocol as referenced above. These samples will be independently collected with separate sampling equipment or with the original sampling equipment after it has been properly decontaminated. For tracking purposes, the parent/duplicate sample relationship will be recorded in accordance with sample documentation requirements stated in the governing guidance document. These samples will be used to determine the variability of sample results in a given land use area. These samples will not be used to determine variability in sampling techniques.

Section 6
Site Cleanup

IDW will be managed as prescribed in Section 3.2.10 of the Site-wide QAPP [SWQAPP] (CDM 2007b) or other applicable governing guidance documents. In general, replace the soil plug with excess sample volume. The soil should be placed back into the hole and tamped down lightly. If sandy areas such as playgrounds are sampled, refilling the soil plug is not necessary.

Rinse water, the roots of vegetation removed during sampling, and any excess soil volume may be returned to the sampled area.

Section 7
Documentation

A field logbook/PDA will be maintained by each individual or team that is collecting samples as prescribed in Section 3.2.4 of the SWQAPP (CDM 2007b) or other applicable governing guidance documents. Guidance documents will detail conditions which require attention, but at a minimum the following information should be collected:

- Project name
- Title of governing documents
- Property address
- Date
- Time

- Team members
- Weather conditions
- PPE used
- Locations of any samples or sub-samples that could not be acquired
- Descriptions of any deviations to the SAP or SOP and the reason for the deviation
- Relinquishment of samples to project sample coordinator

Complete required documentation as detailed in applicable governing guidance documents.

Section 8
Quality Assurance/Quality Control

Quality control samples will include:

- Field duplicates

Detailed information on QC sample collection and frequency is prescribed in Section 3.1.3.2 of the SWQAPP (CDM 2007b) or other applicable governing guidance documents.

Section 8
Decontamination

All sampling equipment must be decontaminated prior to reuse. Specific instructions on sample equipment decontamination are included in the applicable governing guidance documents. In general, the procedure to decontaminate all soil sampling equipment is outlined below:

- Remove all visible contamination with plastic brush
- Use DI water and plastic brush to wash each piece of equipment
- Remove excess water present on the equipment by shaking
- Use a paper towel to dry each piece of equipment
- Wrap dried equipment in aluminum foil

Once a week all soil sampling equipment will be cleaning using Alconox and DI water.

Spent wipes, gloves, aluminum foil, and PPE must be disposed of or stored properly as IDW, specified in Section 3.2.10 of the SWQAPP (CDM 2007b) or other applicable governing guidance documents.

Section 9
Sample Custody

Field sample custody and documentation will follow the requirements described in Section 3.2.11 of the SWQAPP (CDM 2007b) or other applicable governing guidance documents.

Section 10
Glossary

Governing guidance documents - The written document that spells out the detailed site-specific procedures to be followed by the project leader and the field personnel for completing specific investigations. These documents will clearly indicate specific requirements for the implementation of this SOP.

Libby Superfund Site – The Libby Superfund Site contains all buildings and land within the boundaries of each operable unit (OU) of the site and illustrated on the most recent version of the OU boundary map.

Sub-sample - The actual location at which the sample is taken. The dimension of a sample point is 2 inches across by 3 inches deep (6 inches for SUAs).

Composite Sampling - A sample program in which multiple sample points are compiled together and submitted for analysis as a single sample.

Land Use Area - A section of property segregated by how the property owner uses the area. The area can be classified as a SUA, LUA, CUA, ISA, or NUA.

Section 11
References

CDM. 2007a. Semi-Quantitative Visual Estimation of Vermiculite in Soils at Residential and Commercial Properties, Revision 1. CDM-LIBBY-06.

CDM. 2007b. Site-Wide Quality Assurance Project Plan. Draft in review.

SOIL SAMPLE PREPARATION

SYNOPSIS: This is a standardized method for the preparation of fine and coarse-grain soil samples collected at the Libby Asbestos Superfund Site for asbestos analysis at an approved laboratory.

APPROVALS:

USEPA Region 8

Signature Date

Print Name

Title

ESAT Region 8

Signature Date

Print Name

Title

RECORD OF CHANGES

Revision	Date	Principal Changes and Author
0	Unknown	This SOP was originally prepared by ISSI Consulting Group. ISSI is no longer in existence, and finalization of the SOP was performed by William Brattin at Syracuse Research Corporation (SRC).
1	01/07/2000	Incorporated sieving to the sample preparation
2	07/12/2000	Revision in sieve size and other minor edits
3	05/07/2002	Incorporated minor edits
4	08/01/2002	Modified sieving procedure and added grinding step
5	03/06/2003	Incorporated modifications to the procedure and documentation requirements
6	03/24/2003	Incorporated modifications to the log sheets to conform with electronic data storage requirements and added grinder blank requirements
7	08/05/2003	Incorporated modifications to drying and sample storage procedures
8	05/04/2004	Incorporated modifications to drying batch size and recording of preparation information
9	05/14/2007	Incorporated modifications so as to expand use to other Operable Units (removed references to OU4/CSF, changed Index ID to Sample ID). Repaired formatting. Removed reference to missing Figure 1. Added optional use of electronic logs. Oven temperature set to 90 ± 10 degrees C. Lowered inventory batch size from ~120 to ~50 samples so that one inventory batch can fit in one tub. Designated drying batch as one batch per oven (~20 samples). Allowed for optional use of disposable drying pans. Removed direction to NOT move grinding plates during decontamination (new BICO design allows plates to be separated for decontamination without adjusting gap). Ovens will be calibrated daily. *[Note: Revision 9 was as unsigned version that reflects changes made at the Troy Sample Preparation Facility. Some of the changes in Revision 9 are retained in Revision 10, below].*
10	12/06/2007	Incorporated modifications so as to expand use to other Operable Units. Designated drying batch as ~20 samples. Allowed for optional use of disposable drying pans. Allowed alternative methods for decontamination of plate grinder. Clarified and modified QC requirements. General editing for clarity.
11	07/27/2012	Entire SOP review and update provided by ESAT Region 8, which includes procedures for equipment calibration.

TABLE OF CONTENTS

LIST OF ATTACHMENTS

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to standardize the methods used to prepare soil samples collected at the Libby Asbestos Superfund Site (referred to as the Libby Site from this point forward) for the analysis of asbestos content by an approved laboratory. This SOP is specifically intended for application at the Libby Site and focuses on homogenizing soils and soil-like materials in order to produce equal fractions of the original sample with reproducible results.

2.0 SCOPE AND APPLICATION

Soil samples from the Libby Site are processed at the Environmental Services Assistance Team (ESAT) Region 8 Troy Sample Preparation Facility (SPF) before submittal to the laboratory for analysis. This process separates the coarse fraction of the soil from the fine fraction. The fine fraction constitutes all material passing through a ¼-inch sieve. The fine fraction is homogenized and ground to a maximum particle size of approximately 250 microns (µm). This fine fraction is further sub-divided into four fractions using a riffle splitter. One or more of these fractions is then submitted to an approved and accredited laboratory for polarized light microscopy (PLM) analysis.

3.0 RESPONSIBILITIES

3.1 It is the responsibility of the SPF supervisor to ensure that all preparation, quality assurance (QA) and quality control (QC) procedures are performed in accordance with this SOP and to identify and take appropriate corrective action to address any deviations that may occur during sample preparation.

3.2 The ESAT Team Manager, QA Coordinator (QAC), and/or SPF Lead will communicate with project managers at the United States Environmental Protection Agency (EPA; also referred to as the client), or their designate, any situations where a modification to or deviation from the SOP may be useful or necessary. ESAT must receive approval from the EPA for any deviation or modification from the SOP before incorporating any such deviation or modification into the sample preparation process (refer to Section 8.2).

3.3 All SPF personnel are responsible for reading and understanding the SPF-specific Health and Safety Plan (HASP) and performing all tasks in accordance with the requirements of the HASP.

4.0 METHOD DESCRIPTION

Soil samples received at the SPF are dried in a laboratory oven, and then split into a preparation sample and an archive sample. The preparation sample is sieved to separate coarse material (>¼-inch) from fine material (<¼-inch). The fine material is ground to a particle size of less than 250 µm, and this fine ground material is split into several aliquots. This grinding step is needed to achieve a reasonable degree of homogeneity in the sample, and to allow for preparation of slides for PLM analysis. The coarse fraction (if any) and one aliquot of the fine ground material are then sent to an approved analytical laboratory for PLM analysis. Fine-ground samples are analyzed according to the current version of SOP SRC-LIBBY-03, *Analysis of Asbestos Fibers in Fine Soil by Polarized Light Microscopy*, and coarse samples are analyzed according to the current version of SOP SRC-LIBBY-01, *Qualitative Estimation of Asbestos in Coarse Soil by Visual Examination Using*

Stereomicroscopy and Polarized Light Microscopy. Sample fractions that are not sent to an analytical lab for analysis are stored in an archive facility currently maintained by SPF personnel. Fractions are tracked both on paper and electronically.

5.0 ACRONYMS

ACM	Asbestos Containing Material
EPA	United States Environmental Protection Agency
ESAT	Environmental Services Assistance Team
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HEPA	High Efficiency Particulate Air
LA	Libby Amphibole
NIST	National Institute of Standards and Technology
OSHA	Occupational Safety and Health Administration
PE	Performance Evaluation
PLM	Polarized Light Microscopy
PPE	Personal Protective Equipment
QA	Quality Assurance
QAC	Quality Assurance Coordinator
QC	Quality Control
QMP	Quality Management Plan
SOP	Standard Operating Procedure
SPF	Troy Sample Preparation Facility
SRC	Syracuse Research Corporation
USGS	United States Geological Survey

6.0 HEALTH AND SAFETY

6.1 Follow general laboratory health and safety policies and regulations in the HASP, Chemical Hygiene Plan, or equivalent.

6.2 All sample handling and preparation activities must be performed in a ventilated hood with an operating High Efficiency Particulate Air (HEPA) filtration system, a class 1 biohazard hood, or glove box with continuous airflow (negative pressure). Never have a sample container open except when the sample is inside of the sample preparation hood. Appropriate personal protective equipment (PPE) should be worn at all times.

7.0 CAUTIONS

After processing each sample, thoroughly decontaminate all equipment and work surfaces in order to prevent cross-contamination between samples.

8.0 GENERAL LABORATORY PRACTICES

8.1 QA Program

8.1.1 The SPF operates under a QA program appropriate to the type, range, and volume of work it performs.

8.1.2 It is the responsibility of SPF personnel to read, understand, and follow the ESAT Region 8 Quality Management Plan (QMP). Additional QA/QC requirements specific to the SPF are described in Section 18.0.

8.1.3 All work is performed at a permanent location. The SPF is able to carry out all preparation, calibration, and daily QA/QC activities independently, and at one location. There are no remote or sub-facilities where preparation work is performed.

8.2 Documenting SOP Modifications

8.2.1 Any deviation from the SOP shall be documented in a laboratory modification form. Additionally, when there is reason to suspect a departure from the SOP has affected the result or validity of data provided to the client, the client must be notified of the nature of the departure from the SOP and informed about the possible effect on the result or validity of the analysis. The course of action taken to keep the departure from recurring must also be discussed with the client.

9.0 PERSONNEL QUALIFICATIONS

9.1 Personnel performing sample preparation activities must read and understand the HASP and all associated SOPs. In addition, personnel must complete the 40-hour Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) training and the required OSHA 8-hour Refresher courses. Additional training may be identified prior to project implementation and will be administered prior to any individual beginning work at the SPF.

9.2 The health and safety records for all personnel, including HAZWOPER 40-hour and 8-hour certificates must be kept in a central location and available at all times.

10.0 EQUIPMENT AND SUPPLIES

The SPF must be equipped with the following instrumentation, hardware, software, and all other materials and supplies required to perform this SOP. All equipment must be properly maintained and calibrated (as appropriate) prior to use.

- General purpose laboratory oven capable of maintaining a constant temperature of approximately 90^{o}C
- Analytical balance capable of measuring in a range of 0.1 g to at least 2,000 g
- Weight set, traceable to National Institute Standards and Technology (NIST)
- Riffle splitter with ¾-inch chutes
- Plate grinder with plates adjustable from ¼-inch to approximately 250 µm
- Wet/dry vacuum with HEPA filtration
- Compressed air
- Metal scoop or spoon (plastic scoops or spoons are not acceptable)

- ¼-inch metal sieve and catch pan (plastic sieves and pans are not acceptable)
- Shims used for grinder plate calibration
- NIST traceable certified micrometer
- 60-mesh (250 µm) sieve and 200-mesh (74 µm) sieve
- Asbestos-free quartz sand
- Drying pans
- HEPA-filtered hood, a class 1 biohazard hood, or glove box with continuous airflow (negative pressure)
- Vaneometer
- Re-sealable Poly Bags, 4-mil – sizes 4x6 inch and 10x13 inch (these two sizes are standard; however, a larger 4-mil poly bag may used if a larger master sample bag is needed)
- Disposable, powder-free examination gloves (nitrile or latex)
- Half-face respirator with disposable P100 cartridges
- Safety glasses or goggles (Z-87 rated) with side shields
- Tyvek coveralls with attached hood/boots
- Additional PPE required by the SPF-specific HASP
- Sample Drying bench sheets (provided in Attachment 1)
- Sample Preparation bench sheets (provided in Attachment 2)
- Equipment maintenance/calibration logbooks, document controlled
- Self-adhesive sample labels
- Asbestos containing material (ACM) waste bags
- Indelible marking pen
- Water in spray bottles and paper towels (for wet wiping)

11.0 SOIL STORAGE

Upon receipt at the SPF, samples are grouped into an inventory batch of 20 samples, which are assigned an inventory batch number. This number is an identifier in the following format: 12-1014, where 12 = two-digit calendar year (as in 2012) and 1014 = four-digit consecutive number, starting with 0001. Whenever soil samples are not being processed, they are stored in plastic bins or shipping boxes/coolers. The samples do not require refrigeration but must be kept in an orderly, clean fashion. All bins will be assigned a bin identification number, or Bin ID, which is a four-digit consecutive number starting with 0001. The Bin ID is displayed on a prominent hanging tag. Bins will be arranged on labeled shelves by the Bin ID for easy retrieval. All bins will also be labeled with one or more inventory batch numbers. Bin information is tracked by the sample coordinator in an Excel file, which indicates the Bin ID, bin contents, and its physical location within the SPF.

12.0 BULK SOIL DRYING

12.1 Equipment Verification Checks

12.1.1 Samples will be weighed prior to and following drying activities. A verification check of the analytical balance is performed each day when samples are loaded into or unloaded from the oven (note that a verification check is performed on the balance for other soil processing purposed as well, even if samples are not being dried on a particular day). Before weighing samples, perform the verification check using Class 6 weights (equivalent to Class S-1 weights) and record the results, any required maintenance, and the balance number in the Analytical Balance Verification and Maintenance Logbook.

12.1.2 All drying activities will be performed in a HEPA-filtered hood, a class 1 biohazard hood, or glove box with continuous airflow (negative pressure). Prior to loading the oven, use a vaneometer to verify that the hood's ventilation system is operating properly, and record the results and any required maintenance in the Ventilation Hood Verification and Maintenance Logbook.

12.1.3 A HEPA vacuum will be used to decontaminate the oven following the removal of dried samples. A verification check is performed on the HEPA vacuum daily prior to drying activities. All system checks, required maintenance and the vacuum number will be recorded in the HEPA Vacuum Verification and Maintenance Logbook.

12.1.4 An oven temperature verification check will be performed daily during periods of operation. Oven temperature verification checks and any required maintenance will be documented in the Oven Temperature Verification and Maintenance Logbook.

12.2 Drying Procedure

12.2.1 Prior to drying each sample, record the starting sample mass to the nearest 0.1 g on the Sample Drying bench sheet (Attachment 1).

12.2.2 Group samples into drying batches of approximately 20 samples per batch. Assign each batch a drying batch number, and record this number on the Sample Drying bench sheet, as well as the number of the oven used to dry the samples.

12.2.3 Include one preparation blank in each drying batch. See Section 18.1 for more details regarding preparation blanks.

12.2.4 Set the oven temperature to approximately 90±l°C[1]. For every drying batch, check the oven temperature to verify that proper temperature has been reached and document the start date/time and temperature on the Sample Drying bench sheet.

12.2.5 Transfer each sample to be dried from its 4-mil bag into a clean drying pan. Each sample must be transferred to its respective drying pan under the HEPA-filtered hood. Label each drying pan with the Sample ID of the sample. Place each sample in the oven.

12.2.6 Leave the samples in the oven until completely dry (potentially 24-48 hours). Verify that each sample is dry by squeezing a portion of the soil with a freshly gloved thumb and forefinger to test the cohesiveness.

12.2.7 Turn off the oven and allow the samples to cool in the oven. Once the samples are cooled, unload each sample and transfer each sample to a clean, 4x6 inch 4-mil poly bag, re-bag the sample with another clean, 4x6 inch 4-mil poly bag, and identify the dried sample with the Sample ID. All samples should be transferred to 4-mil poly bags in the HEPA-filtered hood to prevent potential exposure to asbestos fibers that might be released from the sample.

[1] Drying temperatures in the range of 80-l00°C will not compromise sample integrity, but monitoring of oven temperature to ± 1°C is needed to allow early detection of any problems with the oven temperature control.

12.2.8 Record the sample mass of each dried and bagged sample to the nearest 0.1 g, along with the technician's initials and the date, on the Sample Drying bench sheet.

12.2.9 Once all information on the Sample Drying bench sheet is completed, a second technician must perform a QC check of the information, and initial and date the bench sheet.

12.3 Decontamination

Decontaminate all equipment used (drying pans, the inside of the hood, and the inside of the drying oven) using the HEPA vacuum and wet wiping all surfaces before loading a new batch for drying.

13.0 DIVISION OF ARCHIVE AND PREPARATION SAMPLES

All dried samples are mixed and split into two portions: one portion is held in archive, and the second portion is prepared for shipment to an approved analytical laboratory for asbestos analysis. The sections below describe the sample splitting procedure.

13.1 Equipment Calibration

All splitting, sieving, and grinding activities will be performed in a HEPA-filtered hood, a class 1 biohazard hood, or glove box with continuous airflow (negative pressure). Prior to any splitting, sieving, or grinding activities, use a vaneometer to verify that the hood's ventilation system is operating properly, and record the results and any required maintenance in the Ventilation Hood Verification and Maintenance Logbook.

13.2 Procedure for Sample Splitting

Splitting must be performed in the HEPA-filtered hood to prevent potential exposure to asbestos fibers that might be released from the sample. Samples will be divided using the following procedures:

13.2.1 Place the cooled, re-bagged samples in the hood, and knead the contents of the bag to break up any soil clumps.

13.2.2 Place one collection pan on each side of the riffle splitter. Pour the sample from its 4-mil poly bag through the splitter in order to divide the sample into two equal sub-parts.

13.2.3 After splitting, set aside one portion for sample preparation (preparation procedures described below). If the mass of the portion for preparation is larger than about 200 grams, split the preparation sample again so that ¾ of the original sample will be archived and ¼ will be set aside for processing.

13.2.4 Place the remaining portion(s) into a clean, 4x6 inch 4-mil poly bag, re-bag the sample in another clean, 4x6 inch 4-mil poly bag, and store as an archive sample in the event additional analyses are required in the future. Identify the archive sample with the Sample ID and the suffix "A" (for archive fraction). Record the technician's initials and date in the Sample Preparation bench sheet (Attachment 2). Store the archive portion in the numbered inventory box noted in the Sample Preparation bench.

13.3 Preparation Duplicate Samples

One preparation duplicate sample will be prepared for every 20 field samples processed. A preparation duplicate is generated by using the riffle splitter to divide the preparation fraction into two equivalent portions ("parent" and "duplicate"). The duplicate portion is assigned an independent Sample ID, and both the parent sample and the duplicate sample are then processed in an identical fashion. Each sample is submitted to the laboratory blind, meaning that the laboratory is not made aware of which sample is the parent or the duplicate. For further information on preparation and processing of preparation duplicates, refer to Section 18.4.

13.4 Performance Evaluation Samples

Performance Evaluation (PE) samples are used to assess the accuracy of the analytical laboratory and to check for any potential contamination or loss of asbestos during processing. For further information on preparation and processing of PE samples, refer to Section 18.3.

13.5 Decontamination

13.5.1 The splitter need not be decontaminated following this step if the next use of the splitter will be the division of the fine-ground fraction of the same samples into four fractions (see Section 16.0). If for any reason the next use of the splitter is division of material from a different sample, the riffle splitter must be decontaminated as follows.

13.5.2 Use the HEPA vacuum and compressed air to decontaminate the splitter and brush or wipe off any visible material that is not removed by the air blast. The splitter is now ready to process the next sample.

14.0 SIEVING THE PREPARATION SAMPLE

All preparation samples are sieved prior to grinding to separate the coarse fraction from the fine fractions. The sample sieving procedure is described in the sections below.

14.1 Equipment Calibration

14.1.1 All sieving activities will take place in the HEPA-filtered hood. Prior to any splitting, sieving, or grinding activities, use a vaneometer to verify that the hood's ventilation system is operating properly, and record the results and any required maintenance in the Ventilation Hood Verification and Maintenance Logbook.

14.1.2 Samples are weighed during sieving activities. A verification check of the analytical balance is performed each day when samples are sieved. Before weighing samples, perform the verification check using Class 6 weights (equivalent to Class S-1 weights) and record the results, any required maintenance, and the balance number in the Analytical Balance Verification and Maintenance Logbook.

14.2 Sample Sieving Procedure

14.2.1 Pour the sample onto a clean ¼-inch stainless-steel sieve with a clean pre-weighed catch pan. Shake the screen until all particles <¼-inch in size have passed through the screen into the pan. When needed, a pestle may be used to gently break up any remaining soil clumps to ensure all particles <¼-inch in size pass through the screen.

14.2.2 Pour all material which does not pass through the screen (>¼-inch) into a new, tared, 4x6 inch 4-mil poly bag. This is the Coarse Fraction sample.

14.2.3 Weigh and record the mass of the coarse fraction to the nearest 0.1 g on the Sample Preparation bench sheet and record the technician's initials and the date. If all of the material passes through the screen, such that there is no coarse fraction, record a mass of zero for the coarse fraction on the Sample Preparation bench sheet.

14.2.4 Double-bag the coarse fraction sample in a 4x6 inch 4-mil poly bag, and identify the sample with the Sample ID and "C" suffix on the sample bag. Coarse fraction samples are now ready to be packaged for shipment to the analytical laboratory or archived as directed.

14.2.5 All material that passes through the ¼-inch screen is the Fine Fraction. Weigh and record the mass of the fine fraction to the nearest 0.1 g on the Sample Preparation Log bench sheet.

14.2.6 Whenever possible, immediately process the fine fraction material according to the procedures described in Sections 15.0 and 16.0. If processing cannot occur immediately, pour the fine fraction material into a new 4-mil poly bag and identify the fine sample material with the Sample ID and the suffix "F" (for "fine fraction"). Double-bag the sample and identify the sample with the Sample ID and suffix on the outside of the bag.

14.3 Decontamination

All non-disposable pans and sieves must be decontaminated between samples. Decontaminate sieves and pans (and the pestle, if used) in the HEPA-filtered hood using compressed air. Wipe or brush off any visible material that is not removed from the air blast. A HEPA vacuum may also be used to remove any residual material.

15.0 GRINDING THE FINE-FRACTION SOIL SAMPLES

The fine fraction of each preparation sample will be ground to produce a material of approximately 250 µm[2]. The procedure for grinding the fine fraction is outlined below.

15.1 Equipment Calibration

15.1.1 All grinding activities must take place in the HEPA-filtered hood. Prior to any splitting, sieving, or grinding activities, use a vaneometer to verify that the hood's ventilation system is operating properly, and record the results and any required maintenance in the Ventilation Hood Verification and Maintenance Logbook.

15.1.2 A plate grinder will be used to grind fine-fraction samples to the particle size appropriate for asbestos analysis. Verification checks of the plate grinder will be performed weekly to verify proper particle size (approximately 250 µm) and to demonstrate that samples are not being over-processed. A traceable certified micrometer will be used as a standard to perform the weekly verification checks

[2] Note that the particle size is cited as "approximately 250 µm ". This is due to the nature of grinding asbestos material. Some material that is longer than 250 µm may pass through the grinder if its longest side is parallel with the vertical grinder plates. The material that comes in contact more nearly perpendicular to the vertical grinder plates will be ground to <250 µm.

that the shim being used for calibration is within tolerance (+/-5%). Eventually, shims will fail due to wear, bends, cracks, etc., at which time they will be replaced with a new shim that meets the requirements. The micrometer will be calibrated annually by a third party.

15.1.3 The grinder is adjusted acceptably if, after grinding the clean soil sample, all material passes through a 60-mesh (250 µm) sieve and is substantially retained by a 200-mesh (74 µm) sieve. If a significant amount of the ground clean soil sample is retained on the 60-mesh screen, or if a substantial fraction of the material passes through the 200-mesh screen, adjust the plates of the grinder until these targets are achieved. If the required particle size cannot be achieved even after plate adjustment, other grinder maintenance such as plate replacement may be required. Grinding of field samples cannot resume until the desired particle size is achieved. Document the grinder number, verification of acceptable adjustment, and any observations in the Grinder Verification and Maintenance Logbook.

15.1.4 Samples will be weighed following grinding activities. A verification check of the analytical balance is performed each day when samples grinding activities take place. Before grinding samples, perform the verification check using Class 6 weights (equivalent to Class S-1 weights) and record the results, any required maintenance, and the balance number in the Analytical Balance Verification and Maintenance Logbook.

15.2 Grinding Blanks

One grinding blank per grinder will be prepared daily, and will be associated with all samples prepared by that grinder on that day. For further information on grinding blanks refer to Section 18.2.

15.3 Grinding Fine-Fraction Soil Samples

15.3.1 The sample portion that was sieved to <¼-inch will be ground to a particle size of approximately 250 µm. Set up a catch pan under the grinder to collect all the ground material. Take the fine-fraction preparation sample set aside in Section 13.2, load the grinder hopper, and allow the fine-fraction sample to pass through the plate grinder into the catch pan. Note the technician's initials, date of grinding, and grinder number on the Sample Preparation bench sheet.

15.3.2 The net recovery of fine ground material must not be less than 90% of the mass of fine material placed into the grinder. If recovery is less than 90%, soil grinding must be stopped and the grinder re-adjusted until the mass recovery of test sand and/or soil samples exceeds 90%.

15.4 Decontamination of the Plate Grinder

15.4.1 If the plate grinder can be readily disassembled for cleaning without altering its grinding properties, disassemble the grinder and clean the chutes and plates with the HEPA vacuum and compressed air. Then, if needed, wet wipe to ensure decontamination. If wet wiping is used, the plates and chutes must be thoroughly dried before reassembly.

15.4.2 If the grinder is not easily disassembled, clean the grinder with the HEPA vacuum and several blasts of compressed air, paying special attention to areas where dust from the grinding process is known to accumulate (e.g., between the plates and areas adjacent to the catch pan clamps).

15.4.3 Pass an aliquot of approximately 20 g of asbestos-free quartz sand through the grinder to clean out any residual soil.

15.4.4 Discard the quartz sand and re-clean the grinder with the vacuum and another round of high pressure air blasts. After this decontamination procedure, the grinder is ready to process the next sample.

15.4.5 In general, all soil containers, hoppers and catch pans associated with use of the grinder should be decontaminated using the HEPA vacuum and/or wet wiping, followed by a blast of high pressure air.

15.5 Decontamination of the Calibration Sieves

15.5.1 The stacked sieves used to calibrate the plate grinder will be decontaminated using the HEPA vacuum and compressed air between calibration uses.

16.0 SPLITTING FINE-GROUND SOIL SAMPLES

Fine-ground soil samples should be distributed into four approximately equal sub-samples using a splitter. All splitting activities will be performed in the HEPA-filtered hood. Prior to any splitting activities, use a vaneometer to verify that the hood's ventilation system is operating properly, and record the results and any required maintenance in the Ventilation Hood Verification and Maintenance Logbook.

16.1 Splitting Procedure for Fine-Ground Sample

The following method for splitting a soil sample was adapted from EPA Method 540-R-97-028 (EPA, 1997).

16.1.1 Set up receiving pans on each side of the splitter. Load the soil from the grinder catch pan into the splitter, collecting the sample in two receiving pans.

16.1.2 Tap the catch pan vigorously several times to free any remaining material. Tap the splitter to facilitate the flow of all material through the chutes into the receiving pans.

16.1.3 Empty one receiving pan into the grinder catch pan and the other receiving pan into the sieve catch pan. Set the sieve catch pan aside; this portion of fine ground sample will be split again later.

16.1.4 Replace the receiving pans under the splitter. Take the grinder catch pan, containing half of the fine ground sample, and re-load the contents into the splitter as detailed above.

16.1.5 Repeat the process of dispersing the sample material by shaking the catch pan and tapping the splitter to uniformly distribute the sample. The resulting splits are the "FG1" and "FG2" portions on the Sample Preparation bench sheet.

16.1.6 Take these two portions and carefully transfer each into a clean, tared, 4x6 inch 4-mil poly sample bag. Re-bag each sample portion in another clean, 4x6 inch 4-mil poly sample bag. Identify each fine ground sample with the Sample ID, the suffix "FG" (for "fine fraction, ground"), and the fraction number (e.g., CS-12345-FG1 for fine ground fraction #1). Set aside the FG1 and FG2 fractions of the sample.

16.1.7 Place the two empty receiving pans from the FG1 and FG2 fractions next to the splitter. Repeat the splitting procedure using the other fine ground portion set aside in the sieve pan and split the remaining sample material to create the "FG3" and "FG4" portions.

16.1.8 Take the remaining "FG3" and "FG4" portions and carefully transfer each into a clean, tared, 4x6 inch 4-mil poly sample bag. Re-bag each sample portion in another clean, 4x6 inch 4-mil poly sample bag. Identify the FG3 and FG4 fractions according to the procedures in Section 16.1.6.

16.1.9 Weigh each sample fraction (FG1 through FG4), and record each mass, along with the technician's initials and date, on the Sample Preparation bench sheet.

16.1.10 Combine all of the bagged coarse and fine portions of the sample into one large clean, 4-mil poly bag (10x13 inch).

16.1.11 Coarse and fine-ground samples are now ready to be packaged for shipment to the analytical laboratory or archived as directed. When samples are requested for shipment, randomly select one of the fine-ground fractions to send to the analytical laboratory. If further analyses are required of the fine-ground fractions, the remaining fractions will be double bagged and sent. All archived fine-ground fractions will be filed in the appropriate inventory archive box noted on the Sample Preparation bench sheet.

16.2 Decontamination

The splitter must be decontaminated between each sample. Use the HEPA vacuum and/or wet wiping followed by a blast of compressed air to decontaminate the splitter, and brush or wipe off any visible material that is not removed by the vacuum or air blast. The splitter is now ready to process the next sample.

17.0 DOCUMENTATION

17.1 Sample ID numbers are recorded on the Sample Drying bench sheet, Sample Preparation bench sheet, and on all sample containers. Once all information on the Sample Drying bench sheet and Sample Preparation bench sheet is completed, a second technician must perform a QC check of the information, and initial and date the bench sheet. Sample Drying bench sheets and Sample Preparation bench sheets will be filed or archived according to their associated dry batch and preparation batch number. If revisions to the Sample Drying bench sheets and/or Sample Preparation bench sheets are necessary, the appropriate parties will be notified of the changes; however, these changes will not necessitate revision to the current SOP. Instead, a modification form will be filled out to document the revisions.

17.2 Equipment verification and maintenance logbooks are completed each day equipment is used. Once an entry made in a logbook is complete, a second technician must perform a QC check of the entry, and initial and date the logbook.

17.2.1 An additional logbook must be completed by SPF personnel each day sample preparation activities take place (Daily Activities Logbook). The Daily Activities Logbook must contain the following information:

- Date
- Time
- Personnel initials who worked that day

- PPE used
- SOP and any other laboratory-specific governing plan being followed
- Descriptions of any deviations from the SOP, including the reason for the deviation, and/or any modification forms being followed
- Summary of the daily activities (including number of samples prepared, and equipment used)
- Any additional comments

18.0 QUALITY CONTROL

QC samples are inserted into the sample processing train to monitor for potential contamination introduced during the preparation process and to assess accuracy of analyses that may be affected by the preparation procedures. If sample results indicate the occurrence of contamination or inconsistent results, the ESAT Team Manager, QAC, and SPF Lead will be notified. The ESAT Team Manager or QAC will then notify the client in order to review laboratory procedures and identify any changes in the SOP that may be necessary. Any such reviews and resultant changes will be documented accordingly by the SPF Lead.

18.1 Preparation Blanks

18.1.1 A preparation blank is a sample of approximately 200g of asbestos-free quartz sand that is treated identically to a field soil sample. That is, the preparation sample is dried in the oven along with the field soil samples, split into archive and preparation fractions using a riffle splitter, screened through a ¼-inch sieve (even though there are no particles larger than ¼-inch), and ground by passing through the plate grinder. This type of sample is intended to detect contamination that may occur at any stage of the soil preparation procedure.

18.1.2 At least one preparation blank will be processed with each drying batch of 20 field samples. Preparation blanks will be assigned a random, unique Sample ID and will be submitted to the laboratory blind. The Sample ID assigned to each preparation blank must follow the numbering system specified in the program-specific project plan.

18.1.3 Detection of asbestos fibers in any preparation blanks at a level greater than non-detect by PLM-Visual Estimation should be taken as a sign of potential cross-contamination, and all field samples associated with the preparation batch for the preparation blank having detectable asbestos will be reviewed and qualified appropriately if detectable levels of asbestos are also found in any of the corresponding field samples. If the overall fraction of preparation blanks that contains detectable asbestos exceeds 1%, a review of laboratory procedures should be undertaken to identify and address the source of the contamination.

18.2 Grinding Blanks

18.2.1 A grinding blank consists of 100-200 grams of asbestos-free quartz sand that is passed through the plate grinder. The purpose of this type of sample is to evaluate the effectiveness of decontamination procedures for the plate grinder.

18.2.2 One grinding blank per grinder will be prepared for each day that field samples are being ground. Each grinder used in the laboratory will be assigned a number and all samples processed will be associated with the grinder used for preparation. The grinder number used for each sample will be recorded on the Sample Preparation bench sheet. Grinding blanks will not be dried, split for archive, or sieved. Rather, a grinding blank will only be ground and split into four fine-ground samples. The grinding blank is assigned a random and unique Sample ID and is submitted to the laboratory blind. The Sample ID assigned to each grinding blank must follow the numbering system specified in the program-specific project plan.

18.2.3 Detection of asbestos fibers in any grinding blank at a level greater than non-detect should be taken as a sign of potential cross-contamination, and all field samples associated with the grinding blank that reports detectable asbestos will be reviewed and qualified appropriately if detectable levels of asbestos are also found in any of the corresponding field samples. If the overall fraction of grinding blanks that contains detectable asbestos in a soil preparation facility exceeds 1%, steps should be taken to develop an improved method for grinder decontamination.

18.3 PE Samples

18.3.1 PE samples consist of asbestos-free soil that is spiked with a known quantity of Libby Amphibole (LA) asbestos. These samples were created by the United States Geological Survey (USGS) for use at the Libby Site by spiking uncontaminated soil from Libby with a known mass of LA collected at the mine site, and then grinding the sample to a particle size of ≤250 µm as described above. Several different concentration values of PE samples were prepared, ranging from < 0.1% to 2%.

18.3.2 PE samples will be utilized in the two following ways:

18.3.2.1 First, the SPF will insert unprocessed PE samples into the sample processing train of samples being sent to the laboratory for PLM analysis. This type of PE sample is intended to evaluate the performance of the analytical laboratory (rather than the SPF).

18.3.2.2 Second, the soil preparation laboratory will process PE samples in the same way that field soil samples are processed, with the exception of splitting the samples due to the limited quantity of each PE sample. This type of PE sample is intended to determine if there is any loss of asbestos during sample processing. In addition, considered in conjunction with a grinding blank that is passed through the decontaminated grinder immediately following the PE sample, the PE sample will also be used to facilitate assessment of grinder decontamination procedures.

18.3.3 The frequency of PE samples is one per quarter or as directed by the client. The asbestos concentration of the PE sample to be used, the type of PE sample (processed or unprocessed), and the analytical laboratory that will receive the PE sample will also be at the direction of the client.

18.3.4 Results of PE samples processed by the SPF are evaluated by the client by comparing the reported results for LA to the nominal values. Deviations from nominal values may be the result of variations either in soil processing procedures and/or in the analytical procedure. If the frequency of strongly discordant results exceeds 10%, then the source of the inconstancy should be investigated and remedied.

18.4 Preparation Duplicates

18.4.1 A preparation duplicate is prepared by using a riffle splitter to divide a field soil sample into two approximately equal portions, creating a parent and duplicate sample. Both samples are then processed in the same fashion. The preparation duplicate is assigned a unique Sample ID, and is submitted to the laboratory blind. The Sample ID assigned to each preparation duplicate must follow the numbering system specified in the program-specific project plan.

18.4.2 Preparation duplicate samples will be processed at a rate of 5% of the field samples processed (approximately one preparation duplicate for every 20 field samples prepared). Results from duplicate samples serve to evaluate the precision of the combined sample preparation process and the laboratory analysis. Inconsistent results between parent and duplicate samples may be due to variability in sample preparation, sample analysis, and/or to small scale variability in the sample that is not fully controlled by mixing and splitting. If the overall frequency of strongly discordant results (i.e., the results for the parent sample and duplicate are different by more than one bin category according to the current version of Libby-specific SOP SRC-LIBBY-03) is greater than 10%, steps should be taken to identify and address the source of the variability in the sample preparation procedure.

18.4.3 The rate of preparation duplicate samples should be tracked in a spreadsheet to ensure the rate is 5% of field samples processed.

19.0 DECONTAMINATION

All non-disposable equipment used during soil sample preparation must be decontaminated prior to use. Scoops, spoons, splitters, sieves, and drying pans that are re-used must be decontaminated with the HEPA vacuum, compressed air, wet-wiping, and/or by brushing off any residual material. If soil particles are visible on any of the equipment, repeat the decontamination procedure until the equipment is clean.

Note: To reduce the potential for human exposure to asbestos in the SPF, compressed air should be used carefully according to the manufacturer's instructions and only in the HEPA-filtered hood.

20.0 REFERENCES

20.1 American Society for Testing and Materials. 1998. Standard Practice for Reducing Samples of Aggregate to Testing Size. ASTM Designation: C 702 - 98, 4 p.

20.2 United States Environmental Protection Agency. 1997. Superfund Method for the Determination of Releasable Asbestos in Soils and Bulk Materials. Method 540-R-97-028.

ATTACHMENT 1

Libby Asbestos Superfund Site Sample Drying Bench Sheet

Sample Drying Bench Sheet

TechLaw, Inc. ESAT Region 8
Troy Sample Preparation Facility

SOP: ISSI-LIBBY-01, Rev. 11
Oven No.: ________________

Batch ID: (YY-####)	COC:	Due Date:
Begin Date: (MM/DD/YY)	Begin Time: (HH:MM)	Begin Temp: C °
End Date: (MM/DD/YY)	End Time: (HH:MM)	End Temp: C °
Beginning Technician(s):	Ending Technician(s):	

Sample ID:	Wet Weight (g)	Dry Weight (g)	Drying Comments
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			

* Each dried sample will be temporarily stored in a plastic tote identified by a Batch ID in the format "YY-# # # #" (e.g.,10-1000)

Comments: ____

____

QC: _______________ CK COC: _______________ Date: _______________ Loaded: _______________ Shipped: _______________

ATTACHMENT 2

Libby Asbestos Superfund Site Sample Preparation Bench Sheet

Sample Preparation Bench Sheet

TechLaw, Inc. ESAT Region 8 — SOP: ISSI-LIBBY-01, Rev. 11

Troy Sample Preparation Facility — Preparation Batch: ____________________

	Sample ID	Inventory ID	Drying Batch ID	Archive Sample	Duplicate Sample	Sieving			Sample Grinding		Sample Splitting					Comments (indicate if Grinder Blank, Prep Blank, or Duplicate Pair; for Duplicate Pair, enter the parent ID)	QC
						Sample Mass (g)					Sample Mass (g)						
				Initials and Date	Initials and Date	Coarse Fraction (> 1/4")	Fine Fraction (< 1/4")	Initials and Date	Initials and Date	Grinder #	FG1	FG2	FG3	FG4	Initials and Date		Initials and Date
1																	
2																	
3																	
4																	
5																	
6																	
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EPA Data Management Plan

Libby Asbestos Superfund Site

Prepared by EPA's Emergency Response DATA Team

Version 2012.1

January 18, 2012

TABLE OF CONTENTS

List of Tables

List of Figures

Appendices

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RECORD OF CHANGES

Revision Number	Revision Date	Responsible Party	Principal Changes (If other than entire document, list sections)
2011.1	06/27/2011	EPA Emergency Response DATA Team	Entire document
2011.2	12/19/2011	EPA Region 8 ERT DATA Team	Entire document updated for 2012 season.
2012.1	1/18/2012	EPA Region 8	To add detail about data management tools, roles and responsibilities of the laboratory coordinator and more detail about EPA audits for the sitewide QAPP.

ACRONYMS

A&E	Architecture and Engineering
CDM	Camp Dresser & McKee
COC	Chain-of-Custody
DMP	Data Management Plan
EDD	Electronic Data Deliverable
EPA	United States Environmental Protection Agency
EPIF	Exterior Property Inspection Form
ERS	Environmental Resource Specialist
ERT	Environmental Response Team
ESAT	Environmental Services Assistance Team
FSDS	Field Sample Data Sheet
GIS	Geographic Information System
ID	Identification
IPIF	Interior Property Inspection Form
LA	Libby Amphibole
MT DEQ	Montana Department of Environmental Quality
OIF	Occupant Information Form
O&M	Operations and Maintenance
OU	Operable Unit
PCC	Property Close Out Checklist
POC	Property Operations Coordinator
QA	Quality Assurance
QATS	Quality Assurance Technical Support
QC	Quality Control
RAC	Remedial Action Contract
SOP	Standard Operating Procedure
TAPE	Troy Asbestos Property Evaluation
TOAD	Troy Owner Access Database
Udig	Utility Locator Program
USACE	United States Army Corps of Engineers
VVEF	Visible Vermiculite Estimation Form

1.0 GENERAL INFORMATION

This Data Management Plan (DMP) documents the data management processes and deliverables required by the United States Environmental Protection Agency (EPA) at the Libby Asbestos Superfund Site (Site). Adherence to these requirements is critical to EPA's ability to achieve both its short and long term goals at the Site. All modifications to, and variations from, this DMP must be approved by EPA.

MT DEQ is the delegated lead for Operable Unit 7 (the community of Troy) and has implemented slightly different data management tools and processes than are being used elsewhere on the Site. EPA has attempted to point out these differences in this document.

1.1 Scenario

This DMP supports widespread property remediation and removal activities in a small, rural community. It provides data management guidance for:

- Property recruitment, investigations, designs and Remedial Actions including sample collection/preparation/analysis and visible vermiculite assessments.
- Requests and inquiries from the community.
- Environmental Resource Specialist (ERS) and Udig utility locator program responses.
- Other activities including, but not limited to, Background Studies, Ambient Air Monitoring, Risk Assessment, Remedial Investigation and Feasibility Studies.

1.2 Special Considerations

The contaminant of concern is Libby Amphibole (LA). Respiratory exposure to LA is a major public health concern and the Site is the nation's only declared Public Health Emergency. New methods of LA detection and exposure assessment (including laboratory methods, visual observations and field investigations) are consistently being developed and refined. Data collection and management strategies must adapt quickly.

1.3 Privacy Concerns

The Libby dataset includes property addresses and owner contact information.

2.0 COOPERATING AGENCIES AND CONTRACTORS

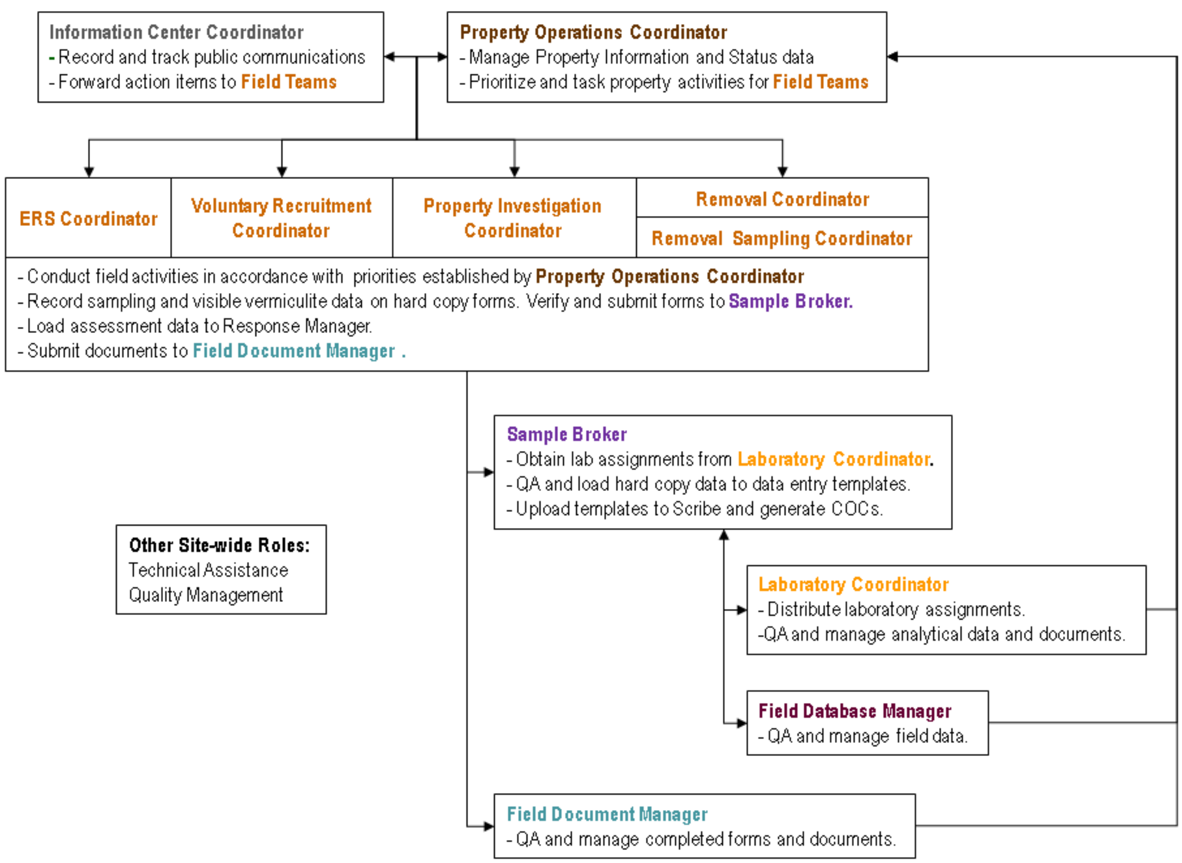
Table 2.1: Agencies and Contracts supporting Operations

EPA R8	**US Environmental Protection Agency, Region 8**
- ESAT	Environmental Services Assistance Team contract
- RAC	Remedial Action contract
EPA ERT	**US Environmental Protection Agency, Environmental Response Team**
- General Support	Direct support contract
EPA R6	**US Environmental Protection Agency, Region 6**
- START	Superfund Technical Assistance and Response Team contract
MT DEQ	**Montana Department of Environmental Quality**
- General Support	Direct support contract funded by IAG with EPA
USACE	**United States Army Corps of Engineers**
- QA + A&E	Quality Assurance contract funded by IAG with EPA
- Removal	Removal contract funded by IAG with EPA
QATS	**Shaw E & I**
-QA	Quality Assurance contract through EPA HQ

3.0 WORK FLOW

This DMP supports the business process illustrated in Figure 3.1. EPA does not assume that each Coordinator will personally perform all the roles and responsibilities described in this document. Rather, EPA assumes that these Coordinators will ensure that appropriate work plans and/or Standard Operating Procedures (SOPs) are developed and implemented to meet the duties detailed in Section 4.

Figure 3.1: Work Flow Diagram



4.0 ROLES AND RESPONSIBILITIES

Table 4.1 shows the specific Roles and Responsibilities that each Agency and Support Contract will perform to ensure a collaborative, interagency approach towards Site operations. Details regarding each Responsibility are provided in Section 4.1.

All Roles will create and update appropriate guidance documents as necessary to meet the Responsibilities defined in this document.

Table 4.1: Roles and Responsibilities

R8 RAC	EPA R8 ESAT	EPA ERT	MTDEQ	USACE A&E	USACE Removal	QATS - Shaw	Role	Responsibility
x			x				Information Center Coordinator	01 Manage and Track Community Requests 02 Verify Property Information 03 Generate and Report Field Documents
x			x				Property Operations Coordinator	04 Verify and Update Existing Information 05 Manage Property Information and Status Data 06 Prioritize and Task Property Operations
			x		x		Voluntary Recruitment Coordinator	02 Verify Property Information 07 Generate and Report Field Assessment Data
x			x				ERS Coordinator	02 Verify Property Information 03 Generate and Report Field Documents 07 Generate and Report Field Assessment Data 08 Schedule Samples for Analysis 09 Collect Samples and Visible Vermiculite Data
x			x	x	x		Property Investigation Coordinator	02 Verify Property Information 03 Generate and Report Field Documents 07 Generate and Report Field Assessment Data 08 Schedule Samples for Analysis 09 Collect Samples and Visible Vermiculite Data
					x		Removal Coordinator	02 Verify Property Information 03 Generate and Report Field Documents 07 Generate and Report Field Assessment Data 10 Update Spatial Database
				x			Removal Sampling Coordinator	08 Schedule Samples for Analysis 09 Collect Samples and Visible Vermiculite Data
x			x				Field Document Manager	11 Manage Field Documents
x			x				Field Database Manager	12 Manage Field Data
x			x				Field Sample Broker	13 Coordinate Sample Analysis
	x						Laboratory Coordinator	14 Coordinate Laboratory Services 15 Manage Analytical Data and Documents
		x					Technical Assistance	16 Maintain System Requirements 17 Provide Data Management Support
	X						Technical Assistance	18 Provide Response Manager Support
						x	Quality Management	19 Validate Data 20 Provide Laboratory Oversight

4.1 Detailed Description of Specific Responsibilities

01 Manage and Track Community Requests

- Maintain a record of property-specific communications made at the relevant Information Center (including ERS and U-dig). Distribute action items to appropriate field personnel and track the status of all actions taken in response to these interactions.
- The Libby Information Center (OU4) will use EPA's Response Manager data management system to manage this information. The Troy Information Center (OU7) will use MT DEQ's TOAD data management system.

02 Verify Property Information

- Verify Property Information and Property Status data found in EPA's Response Manager (OU4) or TOAD (OU7) whenever relevant personnel address a property. It is Montana DEQ or their contractor's responsibility to load data from TOAD into Response Manager.
- Verify property Geographic Information System (GIS) data found in LibbyGeo, including property assignments to GeoUnits and GeoUnit references to other GeoUnits (this includes bundled GeoUnits, GeoUnit encroachments and disputed boundaries).
- Submit a change request to the appropriate Property Operations Coordinator (POC) should any errors arise during the property information and property GIS verification processes. (Appendix D)

03 Generate and Report Field Documents

- Maintain EPA approval for all forms and document templates used in the field.
- Ensure that field teams generate forms and documents in accordance with *EPA's Reporting Requirements for Documents* (see Appendix C).
- Ensure that all field documents are completed and delivered to the appropriate Field Document Manager within 5 business days after the forms and/or documents are completed.

04 Verify and Update Existing Information

- Use existing data, documents and other field resources (including visits and calls to properties and property owners) to verify and update:
    - Property Information and Property Status data found in EPA's Response Manager.

- Documents and metadata found in Response Manager, hard copy records and electronic files.

➢ Create new Property Identifications (IDs) and accurately associate one or more Property ID(s) with every GeoUnit found in LibbyGeo.

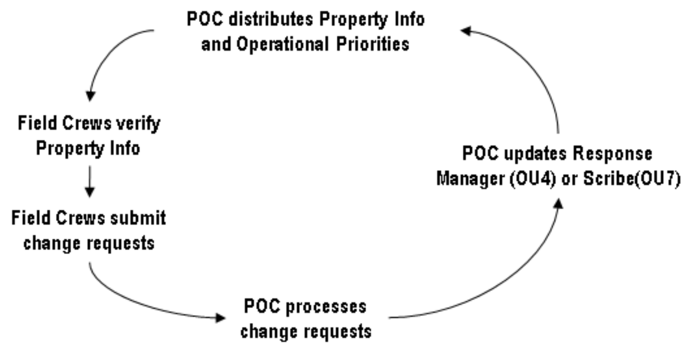
05 Manage Property Information and Status Data

➢ Ensure that all data and documents are correctly associated with an EPA-approved Property ID. This Property ID represents an address or physical landmark that is considered a complete assessment unit for all field activities (including, but not limited to, investigations, designs, removals, and ERS responses).

➢ Ensure that each Property ID is associated with a GeoUnit ID that is found in LibbyGeo (LibbyGeo is a GIS resource that contains OU Boundaries, Removal Zones or neighborhoods and GeoUnits). GeoUnits are, for the most part, tax parcels and other custom spatial polygons representing non-taxable areas such as alleys and parks. Multiple Property IDs can be associated with the same GeoUnit. In most cases one Property ID is associated with one GeoUnit.

➢ Manage Property Information and Property Status data using EPA's Response Manager in accordance with *EPA Reporting Requirements for Tabular Data* (see Appendix A). Ensure that Field Contractors verify address, owner contacts and clean-up status for each property they visit and submit Change Requests to the appropriate Property Operations Coordinator. Coordinate with appropriate Field Database and Document Managers to process changes to the Property Information and Status data found in either EPA's Response Manager (OU4) or TOAD (OU7).

Figure 4.1: Required Data Flow for Property Information



06 Prioritize and Task Property Operations

- Regularly generate and distribute the following official Property Status Lists using data found in either EPA's Response Manager (OU4) or Scribe (OU7). Coordinate with EPA and MT DEQ personnel to prioritize properties on these lists and provide oversight to the United States Army Corp of Engineer's (USACE) Property Coordination Team and other field personnel.

  - Active ERS Property List
  - Voluntary Recruitment List (including eligible properties)
  - Investigation List (including eligible properties, deferments and refusals)
  - Removal List (including eligible properties, deferments and refusals)

07 Generate and Report Field Assessment Data

- Field Contractors will collect the following assessment or survey data and load it to EPA's Response Manager (OU4) or Scribe (OU7). Field Contractors will develop hard copy backup forms for these assessments and carry these forms into the field with them. Contingency mechanisms must be identified to enter this data into Response Manager (OU4) and Scribe (OU7) in the case of equipment malfunction.

- Ensure that data from the following field assessments are correctly entered into EPA's Response Manager within one business day after the data is completed:

  <u>Voluntary Recruitment</u>
  - Voluntary Recruitment Form (OU4)

  <u>Investigations</u>
  - Occupant Information Form (OIF)
  - Interior Property Inspection Form (IPIF)
  - Exterior Property Inspection Form (EPIF)

  <u>Removals</u>
  - Property Close Out Checklist (PCC)

- Ensure that data from the following field assessments are correctly entered into EPA's Scribe Database within one business day after the data is completed:

  <u>Voluntary Recruitment</u>
  - Voluntary Recruitment Form (OU7)

  <u>Investigations</u>
  - Troy Asbestos Property Evaluation (TAPE)

08 Schedule Samples for Analysis

- Coordinate with the relevant Sample Brokers and Laboratory Coordinator to schedule analytical services including sample preparation, analysis and storage. All analytical services besides ERS and other emergency needs must be scheduled before samples are collected.

09 Collect Samples and Visible Vermiculite Data

- Ensure that field teams record data or collect Sampling and Visible Vermiculite data using hard copy field forms (OU4) and PDAs (OU7) in accordance with *EPA Reporting Requirements for Tabular Data* (Appendix A).

- Ensure that data is verified and loaded into templates for upload to Scribe.

- Ensure that corrected spatial coordinates for each sample and visible vermiculite observation are loaded into an EPA-approved data entry template and delivered to the appropriate Field Database Manager within 5 business days after the coordinates were collected.

10 Update Spatial Database

- Ensure that Field Contractors verify the following information that is managed in LibbyGeo: a) Property assignments to GeoUnits; b) the spatial boundaries of each GeoUnit, and; c) GeoUnit references to other GeoUnits for each property. Note that there are three types of GeoUnit references to other GeoUnits at Libby:

  1. Bundled GeoUnits - Property IDs that cross multiple GeoUnits.
  2. Encroachment - Removal activities extend beyond the boundaries of the original GeoUnit.
  3. Disputed Boundaries - Assumed ownership lines do not match GeoUnit boundaries.

- Process Change Requests from Field Contractors and Property Operations Coordinators to information found in LibbyGeo. Ensure that LibbyGeo is updated as appropriate.

- Weekly submit updated versions of Libby GeoUnits to EPA. EPA will regularly review these updates and distribute sanctioned versions of the spatial dataset.

11 Manage Field Documents

- Accept documents (including photos and video) from various field teams, compare these documents against *EPA Reporting Requirements for Documents* (see Appendix C) and coordinate a resolution with document providers should any issues arise. Relevant Field Document Managers are required to 1) manage originals of all paper and electronic documents for each property on site, and 2) manage electronic copies of select documents using EPA's Response Manager (OU4) or OSC.net (OU7).

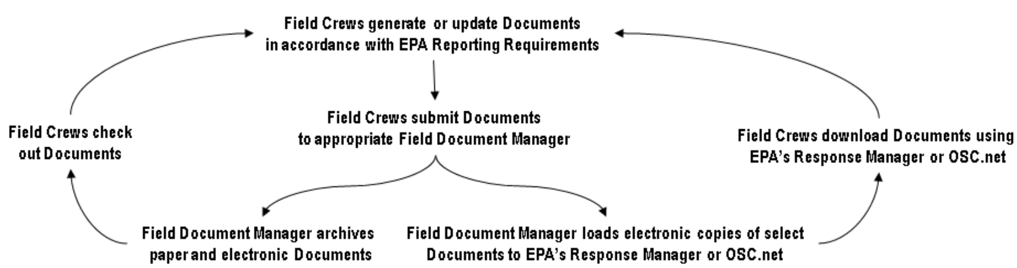
- Obtain SDMS Document IDs from EPA for each document. Maintain metadata for all documents and records (including photos and video) using EPA's Response Manager (OU4) or OSC.net (OU7). Metadata requirements are described in Table 4.2.

Table 4.2: Metadata Requirements for Documents and Records

Required?	Field Name	Description	Data Type
Yes	DocumentID	EPA-generated identifier that is associated with a specific document. Serves as the Primary Key.	Text (50)
Yes	PropertyID	EPA-generated identifier for a specific property that this Document is to be associated with. Serves as the Foreign Key to the EPA reporting table named "PropertyInfo" in Scribe.	Text (50)
Yes	Type	Type of document or record being submitted. See Appendix C for approved document types.	Text (50)
Yes	Date	Date that the document was created.	Date/Time
No	Comments	Comments pertaining to the document. Include revisions.	Text (250)

- Changes to existing documentation that is found within each property's paper file, electronic file and/or EPA's Response Manager and must be coordinated through the appropriate Field Document Manager. It is the responsibility of each Field Document Manager to ensure that all documentation is accurate and entered into Response Manager.

Figure 4.2: Required Data Flow for Documents and Records



12 Manage Field Database

- Verify, update, and report all data in the following data tables within the relevant Scribe Field Database in accordance with *EPA Reporting Requirements for Tabular Data* (see Appendix A). All data must be electronically recorded, reviewed for quality control (QC), loaded to Scribe, and published to Scribe.net within 24 business hours of when it was collected. (Subject to receipt of analytical summary sheet, SAP finalization and details of SAP).
  - Events
  - Locations
  - Visible Vermiculite
  - Samples
  - Chain of Custody (COC)
  - Survey Template
  - Survey Question
  - Survey Answer
  - Survey
  - Survey Result
  - Sample_Tags
  - SamplesAir
  - SamplesSoil
  - SamplesWater
  - SamplesABS
  - SamplesPumpInfo

- Accept FSDS, VVEF and Spatial Coordinate data templates from field personnel, verify this data against project objectives and *EPA Reporting Requirements for Tabular Data* (see Appendix A), and coordinate a resolution with data providers should any issues arise. Load Spatial Coordinate data that passes verification to the relevant Scribe Field Database.

Figure 4.3: Data Flow for Sampling and Visible Vermiculite Data

ESAT maintains and distributes EPA Reporting Requirements for Tabular Data.

↓

Field Crews log sampling and visible data into hard copy forms and do initial QA of completed forms.

↓

Sample Broker QA's completed forms, enters sampling and visible vermiculite data into data entry templates, QA's data entry, generates COC's

↓

Field Database Manager loads data entry templates into Scribe, publishes to Scribe.net, QA's data.

↓

Revisions to sampling and visible vermiculite data go through the Field Database Manager.

↓

Field Database Manager updates Scribe PropertyInfo table from Response Manager

13 Coordinate Sample Analyses

- Verify field documents submitted by sampling crews. Ensure that data from FSDS and VVEF forms are correctly entered into EPA-approved data entry templates. Load templates to Scribe.
- Obtain laboratory assignments from the Laboratory Coordinator. Generate COCs using Scribe. Ship or deliver samples accordingly.
- Ensure that all field forms and data templates are delivered to the appropriate Field Document and Database Managers within one business day after the forms are completed.

14 Coordinate Laboratory Services

- Coordinate with appropriate field personnel and EPA Project Managers to identify analytical needs and schedule appropriate sample preparation, analysis and storage services. Maintain standing laboratory capacity to support ERS and other emergency situations.
- Monitor laboratory capacity and provide laboratory assignments to Sample Brokers.

- Coordinate laboratory communications and provide laboratory oversight.
- Prepare and submit complete data packages to the Quality Management Team for data validation.

15 Manage Analytical Data and Documents

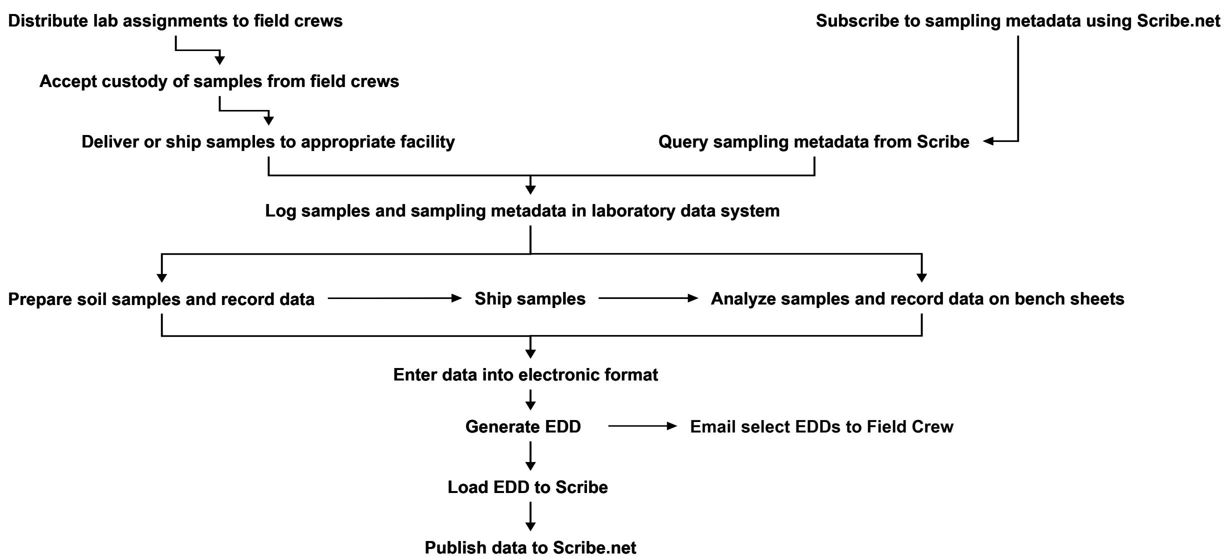
- Maintain, distribute and provide user support for a data management tool that laboratory staff can use to generate consistent and accurate Electronic Data Deliverables (EDDs). ESAT sample preparation and analytical staff will log each sample into the Libby Asbestos Data Tool (LADT). The Sample Login Coordinator will download required sampling metadata from Scribe.net and load this into LADT. Sample preparation and analytical staff will then prepare or analyze the sample according to relevant SOPs. Data produced from analytical instruments will be uploaded into the LADT. Once all of the data has been entered for a particular project, a report is generated which includes a PDF report and an Excel formatted EDD. This EDD is then uploaded into the Scribe project created at the sample login stage. Email preliminary EDDs to field personnel when requested by the ESAT Laboratory Coordinator, and EDDs that meet the requirements of EPA Data Reporting Requirements.

- Accept EDDs from laboratory staff and verify this data against project objectives and *EPA Reporting Requirements for Tabular Data* (see Appendix A). Coordinate a resolution with data providers should any issues arise during the EDD verification process.
- Load data that passes verification to the relevant Scribe Lab Database and publish this data to Scribe.net within two business days after receiving the analysis data. Verify, update and report all data in the following data tables in accordance with *EPA Reporting Requirements for Tabular Data* (see Appendix A).
  - DryingLog
  - GrindingLog
  - Analysis
  - LabResults
  - Structures
  - Validation
  - QualifierDesc
- Incorporate the results of the Quality Management Teams data validation process into the relevant Scribe Lab Database.

- Accept and verify documents from laboratory staff. Coordinate a resolution with document providers should any issues arise.

- Use documents that pass verification to maintain a hard copy file room and electronic record of property-specific documents in accordance with *EPA Reporting Requirements for Documents* (see Appendix C).

Figure 4.4: Required Data Flow for Analytical Data



16 Maintain System Requirements

- Update and distribute the EPA Data Management Plan for the Libby Asbestos Site (including EPA Reporting Requirements) for spatial information, tabular data and documents.

- Develop and maintain checklists and SOPs for use by the various data coordinators to ensure consistency and standardization in all data loading processes.

- Distribute critical identifiers to all Contractors including GeoUnit IDs, Property IDs, Event IDs, Sample IDs, and Document IDs.

- Manage Scribe template and Scribe.net accounts.

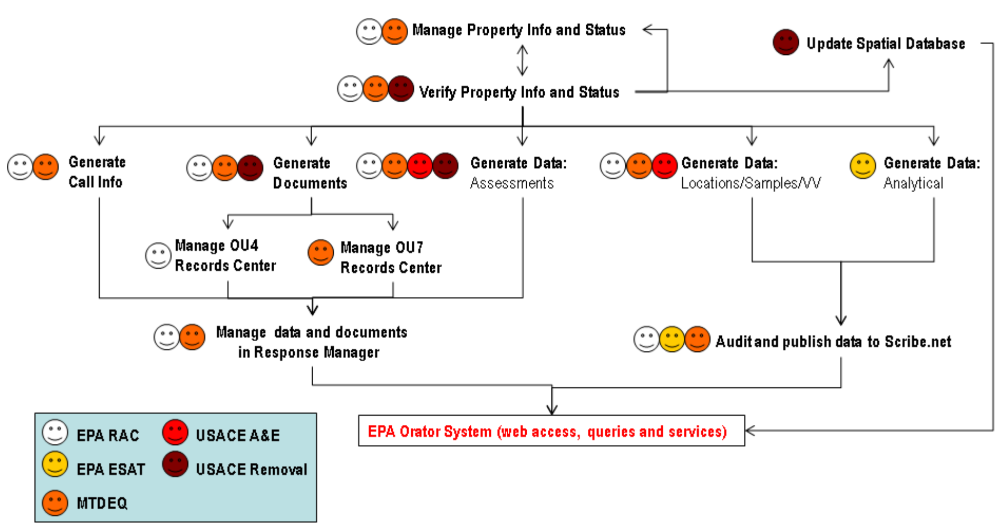
- Manage, maintain and distribute data auditing rules that will be used to check the integrity of submitted datasets.

- Configure, deploy and maintain Scribe and Scribe.NET infrastructure.

17 Provide Data Management and GIS Support

- Develop, deploy and maintain custom applications, queries, processes and tools to support the management of field data, documents and spatial information.
- Develop, deploy and maintain custom applications that will enable site stakeholders to perform dynamic querying and maintain complete situational awareness across all OUs.
- Provide training and user support as required to support the data flow provided in Figure 4.5.
- Facilitate all data management coordination efforts for the site. To include regularly scheduled conference calls, site meetings and infrastructure evaluation sessions between the various data coordinators and site stakeholders.

Figure 4.5: Overall Data Flow Diagram



18 Provide Response Manager and Orator Support

- Develop and deploy core Response Manager and Orator components (see Figure 4.5).
- Provide Response Manager technical support as required to support the data flow provided in Figure 4.5.

19 Validate Data

- ➢ Accept data packages from the Laboratory Coordinator. Compare analytical data against SOPs and report the results of the data validation process to the Laboratory Coordinator.

20 Provide Laboratory Oversight

- ➢ Develop / implement a comprehensive Laboratory Quality Management Plan.

5.0 DELIVERABLES

Table 5.1: Required Data Deliverables

EPA R8 RAC	EPA ESAT	MTDEQ	USACE (A&E)	USACE (Removal)	Role	Deliverable and Reporting Cycle	
x		x			Information Center Coordinator	Response Manager data is QC'd / synched	Daily
x		x			Property Operations Coordinator	Response Manager data is QC'd / synched (EPA RAC) Scribe data is QC'd / published to Scribe.net (MT DEQ) Property Lists are distributed to Field Teams (ALL)	Daily Daily Weekly
				x	Removal Coordinator	Updates to LibbyGeo delivered to EPA	Weekly
x		x			Field Document Manager	Document updates in Response Manager Document updates in Property Files	Daily Daily
x		x			Field Database Manager	Scribe data is QC'd and published to Scribe.net Response Manager data is QC'd / synched	Daily Daily
	x				Laboratory Coordinator	Scribe data is QC'd and published to Scribe.net	Daily

6.0 DATA VERIFICATION

An automated verification of tabular data will be conducted as data is published to Scribe.net. As data providers publish data, and automated set of queries will ensure that all data which is submitted meets *EPA Reporting Requirements for Tabular Data* (see Appendix A) at the Site. If any piece of data does not meet these requirements, it will be flagged and the entire data submittal will be rejected, there may be exceptions made for legacy data.

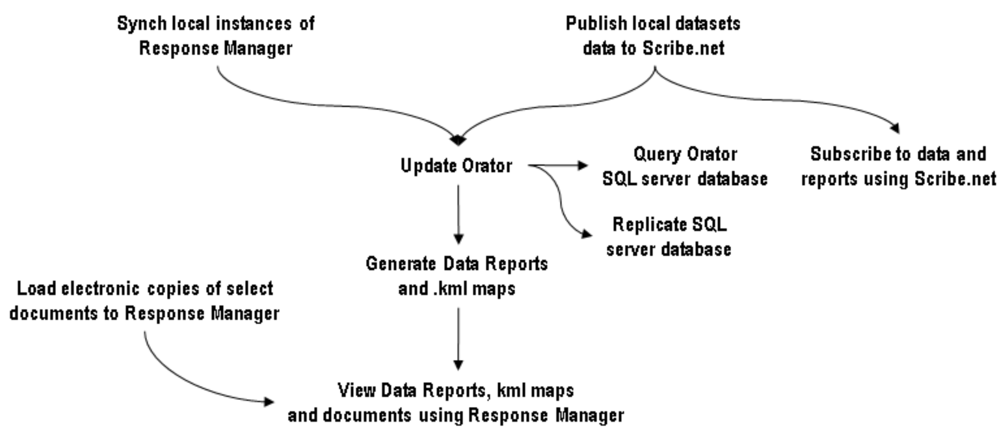
Comprehensive data verification activities will also include regular EPA audits of all data and document management activities.

If issues arise during the data verification process, data providers will have five business days to address the problems that were discovered.

7.0 DATA REPORTING

Data will be reported to users in a variety of ways (see Figure 7.1).

Figure 7.1: Required Data Flow for Reporting



Specifically:

- EPA ERT will maintain subscription accounts that enable users to download all Tabular Data that is published to Scribe.net to their personal computers in a Scribe format.
- In addition to having the ability to utilize Scribe's existing data filtering and export interfaces, users will be able to access data using a standard suite of custom queries found in every Scribe project that is either published or subscribed to using Scribe.net. EPA ERT will maintain this suite of custom queries.
- EPA ERT and Region 8 will establish a site-wide SQL Server database on EPA's Orator platform. Users will be able to access this data directly and/or export copies of the entire Libby dataset using web replication services established by EPA ERT and Region 8.
- Users will be able to download standard queries, data summary tables and important documents from EPAs Response Manager (OU4) and EPA's secure website (OSC.net). EPA ERT and Region 8 will maintain these querying tools.
- When requested, EPA Region 8's ESAT Contractor and/or their subcontractors will send preliminary laboratory data reports directly to field teams.

EPA Region 8's RAC Contractor and MT DEQ's General Support Contractor will provide copies of any document or record managed in either the Libby or the Troy On-Site Records Centers.

Appendix A

EPA Reporting Requirements for Tabular Data

Appendix B

Entity Relationship Diagram for Tabular Data

Appendix C

EPA Reporting Requirements for Documents

Appendix D

Property Operations Coordinators (POC)

OU4

2011	Terry Crowell
2012	Karen Repine

OU7 Randi Dorian

Libby Asbestos Superfund Site
Standard Operating Procedure
Field Logbook Content and Control

Prepared by: Terry Crowell Date: 4/12/12
CDM Smith

Approved by: Dania Zinner Date: 4/12/12
EPA Region 8

Revision No.	Date	Reason for Revision
0	4/12/12	--

1.0 Objective

Logbooks are an essential tool to document field activities conducted by the U.S. Environmental Protection Agency or its contractors in support of the Libby Asbestos Superfund Site (Libby Site). The objective of this standard operating procedure (SOP) is to establish baseline requirements, procedures, and responsibilities for the content and control of Libby Site field logbooks. Additions or modifications to this SOP may be detailed in governing documents referencing this SOP.

2.0 Background

2.1 Definitions

Libby Asbestos Superfund Site (Libby Site) – All buildings and land within the boundaries of the EPA's designated operable units (OUs), as illustrated on the most recent version of the OU boundary map.

Ruler or similar scale – Used with a property-specific drawing or plan to measure distance and sizes of objects, buildings, and zones.

Site – All buildings (if applicable) and land within the boundaries of the EPA's designated geounits, which may represent individual properties within the Libby Site, a collection of properties, or a larger geographical area.

2.2 Discussion

Field logbooks are an accounting of observations and/or activities occurring at or associated with the Libby Site. Field logbooks are also used to duly document changes to or deviations from governing documents referencing this SOP. Information recorded in field logbooks includes date/time, site personnel, observations, calculations, weather, locations of field activities, and a description of the field activity, methods, instruments, and results. Additionally, the logbook may contain descriptions of waste, biota, geologic material, and site features including sketches, maps, or drawings as appropriate.

3.0 Responsibilities

Successful execution of this SOP requires a clear hierarchy of assigned roles with different sets of responsibilities associated with each role. All staff responsible for documenting activities in field logbooks will understand and implement the requirements contained herein, as well as any additional requirements stated in governing documents referencing this SOP.

Team Leader (TL) – The TL is responsible for ensuring that the format and content of data entries are in accordance with this procedure. It is also the responsibility of the TL to communicate the need for any changes to/deviations from the SOP with the appropriate personnel, and document the change/deviation using a Libby Field Record of Modification Form.

Field Team Members – Field team members who make entries in field logbooks are required to read this procedure before engaging in this activity. Field team members will be assigned a field logbook prior to field activities and will be responsible for the care and maintenance of the logbook. Field team members will return field logbooks to the project file at the end of the assignment.

4.0 Equipment

The following is required for the proper completion of field logbooks:

- Logbook
- Indelible black or blue ink pen
- Ruler or similar scale

5.0 Procedures

5.1 Preparation

Commercially available, bound field logbooks with waterproof paper and lined, consecutively numbered pages will be used. Separate field logbooks will be kept for each field activity and the cover (some items may be recorded on the inside cover) of each field logbook shall clearly indicate:

- Field logbook sequence number
- Start date and end date of entries
- Title of document governing field activities
- Activity (if the logbook is to be activity-specific), site name, and location
- Contact name and phone number (typically the Project Manager)

For ongoing field activities that may span months or years, designated staff (e.g., field administrative staff) shall manage the field logbooks by tracking to whom and the date each field logbook was assigned, the general activities recorded in each field logbook, and the date the field logbook was returned to the project file.

The first two pages of the logbook will be reserved for a table of contents (TOC), and the third page will be reserved for abbreviations, acronyms, and definitions.

5.2 Operation

The following general requirements will apply when completing logbook entries for the Libby Site:

- Record equipment calibrations, work, observations, and quantities of materials, calculations, drawings, and related information directly in the logbook. If data collection forms are required by the governing document referencing this SOP, the information collected on the form does not need to be duplicated in the logbook. However, any forms used to record site information must be referenced in the logbook.

- Correct erroneous information recorded in a field logbook with a single line strikeout, initial, and date. The correct information will be entered in close proximity to the erroneous entry.
- Do not start a new page until the previous one is full or has been marked with a single diagonal line so that additional entries cannot be made. Use both sides of each page.
- Do not remove any pages from the logbook.
- Document relinquishment of the logbook from one author to another (both parties must sign and date the transfer).
- Sign and date the final entry each day.
- When columns are used to organize information recorded on laboratory documents, the information recorded in the columns shall be identified in a column heading.
- If any self-adhesive labels are used in the logbook (e.g., sample identification labels, equipment tags), strike through one corner of the label and sign and date the strike-through.

Entries into the field logbook shall be preceded with the time (written in military units) of the observation. The time should be recorded frequently and at the point of events or measurements that are critical to the activity being logged. All measurements made and samples collected must be recorded unless they are documented by automatic methods (e.g., data logger) or on a separate form required by an operating procedure. In these cases, the logbook must reference the automatic data record or form.

At each location where a sample is collected or an observation or measurement made, a detailed description of the location is required and a sketch of the location may be warranted. All maps or sketches made in the logbook should have descriptions of the features shown and a direction indicator. It is preferred that maps and sketches be oriented so that north is toward the top of the page. Any maps, sketches, figures, or data that will not fit on a logbook page, or any separate forms or drawings (e.g., FSDS sheets, drawing markups) required by the governing document referencing this SOP should be referenced in the logbook.

Other events and observations that should be recorded include:

- Changes in weather or site conditions that impact field activities or have the potential to impact data collection (e.g., rain impacting air samples, upwind disturbances)
- Deviations from procedures outlined in any governing documents referencing this SOP, including the rationale and authorization for the deviation as appropriate
- Problems, downtime, or delays
- Visitors to the site

5.3 Post-operation

To guard against loss of data as a result of damage or disappearance of logbooks, completed pages and any supporting attachments shall be periodically photocopied (weekly, at a minimum) and maintained in the project file.

At the conclusion of each field activity or phase of site work, the individual responsible for the logbook will ensure that all entries have been appropriately signed and dated, that corrections were made properly, and that the cover information and TOC are complete. As field logbooks are completed, electronic copies may need to be posted to a project eRoom – refer to the governing document referencing this SOP for requirements. All original logbooks will be catalogued and maintained in the project file.

6.0 Restrictions/Limitations

Field logbooks constitute the official record of onsite technical work, investigations, and data collection activities. Their use, control, and ownership are restricted to activities pertaining to specific field operations carried out by governing agency personnel and their subcontractors. They are documents that may be used in court to indicate dates, personnel, procedures, and techniques employed during site activities. Entries made in these logbooks should be factual, clear, precise, and non-subjective. Field logbooks, and entries within, are not intended for personal use.

7.0 Quality Assurance/Quality Control

Quality assurance/quality control (QA/QC) for activities described in this SOP will be attained through a variety of processes, including, at a minimum, the items discussed below. Additional QA/QC requirements, such as audits or field assessments, will be addressed in the governing document referencing this SOP.

7.1 Training

Every effort will be made to ensure consistency in recording information in field logbooks for Libby Site activities. Consistency will be achieved to the extent possible through proper training, use of designated field staff, and provision of TL oversight. Any deficiencies or inconsistencies in implementing this SOP noted by the TL will require re-training of the field team members.

7.2 Field Checks

Field logbooks may be checked for completeness and adherence to SOP requirements on a daily basis by the TL for the first week of each field activity. These checks can be extended to once per month as field activities continue, and any errors noticed during the checks will be discussed with the author and corrected. If field activities continue beyond six months, the frequency of assessing field logbook entries will be established by the field Quality Assurance Manager.

8.0 References

Adapted from CDM Smith Technical Standard Operating Procedure 4-1, Field Logbook Content and Control, January 2012.

Libby Asbestos Superfund Site
Standard Operating Procedure
Photographic Documentation of Field Activities

Prepared by: ____________________ Date: 4/12/12
CDM Smith

Approved by: ____________________ Date: 4/12/12
EPA Region 8

Revision No.	Date	Reason for Revision
0	4/12/12	--

1.0 Objective

Photographic documentation, which includes still and digital photography and videotape or digital versatile/video disc (DVD) recordings, is an essential tool to document field activities conducted by the U.S. Environmental Protection Agency or its contractors in support of the Libby Asbestos Superfund Site (Libby Site). The objective of this standard operating procedure (SOP) is to establish baseline requirements, procedures, and responsibilities for photographic documentation. Additions or modifications to this SOP may be detailed in governing documents referencing this SOP.

2.0 Background

2.1 Definitions

Arrows and Pointers – Used to indicate and/or draw attention to a special feature within the photograph.

Contrasting Backgrounds – Backdrops used to lay soil samples, cores, or other objects on for clearer viewing and to delineate features.

Data Recording Camera Back – A camera attachment or built-in feature that will record, at the very least, frame numbers and dates directly on the film. Digital cameras and recorders may also be equipped with a date stamping feature.

Identifier Component – Visual components used within a photograph such as visual slates, reference markers, and pointers.

Libby Asbestos Superfund Site (Libby Site) – All buildings and land within the boundaries of the EPA's designated operable units (OUs), as illustrated on the most recent version of the OU boundary map.

Photographer – The camera operator (professional or amateur) for still photography, including digital photography, or videotape or DVD recording, whose primary function with regard to this SOP is to produce documentary or data-oriented visual media.

Reference Marker – A reference marker used to indicate a feature size in the photograph and is a standard length of measure, such as a ruler, meter stick, etc. In limited instances, if a ruled marker is not available or its use is not feasible, it can be a common object of known size placed within the visual field and used for scale.

Site – All buildings (if applicable) and land within the boundaries of the EPA's designated geounits, which may represent individual properties within the Libby Site, a collection of properties, or a larger geographical area.

Slates – Blank white index cards, paper, or a dry-erase board used to present information pertaining to the subject/procedure being photographed. Letters and numbers on the slate will be bold and written with black indelible marking pens.

2.2 Discussion

Photographs and videotape or DVD recordings made during field activities are used as an aid in documenting and describing site features, sample collection activities, equipment used, and conditions during the field activity being performed. This SOP is designed to illustrate the format and desired placement of identifier components, such as visual slates, standard reference markers, and pointers. These items shall become an integral part of the "visual media" that, for the purpose of this document, shall encompass still photographs, digital photographs, videotape recordings (or video footage), and recordings on DVDs. The use of a photographic logbook and standardized entry procedures are also outlined. These procedures and guidelines will minimize potential ambiguities that may arise when viewing the visual media and ensure the representative nature of the photographic documentation.

3.0 Responsibilities

Successful execution of this SOP requires a clear hierarchy of assigned roles with different sets of responsibilities associated with each role. All staff responsible for photographic documentation will understand and implement the requirements contained herein, as well as any additional requirements stated in governing documents referencing this SOP.

Team Leader (TL) – The TL is responsible for ensuring that the format and content of photographic documentation are in accordance with this procedure. The TL is responsible for directing the photographer to specific situations, site features, or operations that the photographer will be responsible for documenting.

Photographer – The photographer shall seek direction from the TL and regularly discuss the visual documentation requirements and schedule. The photographer may be responsible for maintaining a logbook or itemization of photos/recordings or providing captions. Specific requirements will be defined in the governing document referencing this SOP.

4.0 Equipment

The following equipment may be used for photographic documentation:

- 35-millimeter (mm) camera and appropriate film (e.g., medium speed or multi-purpose fine-grain color)
- Disposable, single-use camera (35mm or panoramic use)
- Digital camera
- Video camera and appropriate storage media (e.g., videotapes, DVDs)
- Extra batteries
- Standard reference markers
- Slates

- Arrows or pointers
- Contrasting backgrounds
- Logbook
- Data recording camera back (if available)
- Indelible black or blue ink pen
- Storage medium for digital camera

5.0 Procedures

5.1 Preparation

In addition to this SOP, photographers must be familiar with all procedures applicable to the field activity being performed. These procedures should be consulted as necessary to obtain specific information about equipment and supplies, health and safety (including requirements for personal protective equipment at a site), sample collection, equipment and personnel decontamination, documentation, etc. These procedures should be maintained on site by field staff at all times for easy reference.

The photographer should also be aware of any potential physical hazards while photographing the subject (e.g., traffic, operating equipment, low overhead hazard, edge of excavation area).

If required, a commercially available, bound logbook will be used to log and document photographic activities. Alternatively, a portion of the field logbook may be designated as the photographic log and documentation section.

Because digital cameras and DVD recorders have multiple photographic quality settings, if not specified in the governing document referencing this SOP, the TL shall specify the resolution (quality) at which photographic documentation should be collected. It should be noted that a camera or DVD recorder that obtains a higher resolution (quality) has a higher number of pixels and will store a fewer number of photographs per digital storage medium.

5.2 Operation

The following sections provide general guidelines that should be followed to visually document field activities and site features using still/digital cameras and video equipment. Slate and caption information will not be required at the Libby Site unless specified in the governing document referencing this SOP.

5.2.1 Still Photography

Slate Information

Each new roll of film or digital storage medium will contain on the first usable frame (for film) a slate with consecutively assigned control numbers (a unique, consecutive number that is assigned by the photographer).

Caption Information

Still photographs will have a full caption permanently attached to the back or permanently attached to a photo log sheet. Digital photographs should have a caption added after the photographs are downloaded. Unless modified by the governing document referencing this SOP, captions should contain the following information:

- Film roll control number (if required) and photograph sequence number
- Site name or location

- Description of activity/item shown
- Date and time
- Direction (if applicable)
- Photographer

Close-up and Feature Photography
Close-up photographs should include a standard reference marker of appropriate size as an indication of the feature size.

Feature samples, core pieces, and other lithologic media should be photographed as soon as possible after they have been removed from their *in situ* locations to enable a more accurate record of their initial condition and color for formal lithologic observations and interpretations.

Site Photography
Site photography, in general, consists predominantly of medium- and wide-angle shots. A standard reference marker should be placed adjacent to the feature or, when this is not possible, within the same focal plane. While it is encouraged that a standard reference marker and caption/slate be included in the scene, it is understood that situations will arise that preclude their inclusion within the scene. This will be especially true of wide-angle shots. In such a case, the logbook (field or photographic), photographic caption, or digital file name shall specify all information pertinent to the scene.

5.2.2 Photographic Documentation Using Video Cameras
As a reminder, it is not within the scope of this document to set appropriate guidelines for presentation or “show” videotape or DVD recording. The following guidelines are set for documentary videotape or DVD recordings only and should be implemented at the discretion of the site personnel.

Documentary videotape or DVD recordings of field activities may include an audio slate for all scenes, as directed by the governing document referencing this SOP. At the beginning of each video session, an announcer will recite the following information: date, time (in military units), photographer, site ID number, and site location. This oral account may include any additional information clarifying the subject matter being recorded.

A standard reference marker may be used when taking close-up shots of site features with a video camera. The scene may also include a caption/slate. It should be placed adjacent and parallel to the feature being photographed.

A standard reference marker and caption/slate may be included in all scenes, as directed by the governing document referencing this SOP. The caption information is vital to the value of the documentary visual media and should be included. If it is not included within the scene, it should be placed before the scene.

Original video recordings will not be edited. This will maintain the integrity of the information contained on the videotape or DVD. If editing is desired, a working copy of the original video recording can be made.

A label should be placed on the videotape or DVD with the appropriate identifying information (project name, project number, date, location, etc.).

5.2.3 Photographic Logs

Photographic activities shall be documented in a photographic log or in a section of the field logbook, as directed by the governing document referencing this SOP. The photographer will be responsible for making proper entries.

The following information shall be maintained in the appropriate logbook:

- Photographer name
- Roll/tape/DVD control number (as appropriate)
- Sequential tracking number for each photograph taken (for digital cameras, the camera-generated number may be used)
- Date and time (military time)
- Location
- Description of the activity/item photographed
- Description of the general setup, including approximate distance between the camera and the subject
- Other pertinent information to assist in the identification of the subject matter

5.3 Post-operation

5.3.1 Processing

All film will be sent for development and printing to a photographic laboratory (to be determined by the photographer). The photographer will be responsible for arranging transport of the film from the field to the photographic laboratory. The photographer will also be responsible for arranging delivery of the negatives and photographs, digital storage medium, or videotape or DVD to the TL to be placed in the project file.

Digital media should be downloaded daily to a personal computer or secure server; the files should be in either “JPEG” or “TIFF” format. Files should be renamed at the time of download in accordance with any file-naming conventions required by the governing document referencing this SOP, or to correspond to the logbook. At a minimum, the file name should include the corresponding sampling location and/or sample number and the photograph date (e.g., “123 Elm St_2-15-2011”, “AA-12345_3-18-2009”).

5.3.2 Documentation

At the end of each day’s photographic session, the photographer(s) will ensure that all photographic documentation has been maintained in accordance with this SOP.

5.3.2 Archive

Unless otherwise specified in Libby Site data management requirements or the governing document referencing this SOP, digital photographs will be stored on a secure server (with a nightly backup) or posted to a web-based location (e.g., an eRoom or SharePoint portal). These files will be archived until project closeout, at which time project management will determine a long-term electronic file storage system.

6.0 Restrictions/Limitations

This document is designed to provide a set of guidelines for the field personnel to ensure that an effective and standardized program of visual documentation is maintained.

The procedures outlined herein are general by nature. The photographer is responsible for specific operational activity or procedure. Questions concerning specific procedures or requirements should be directed to the TL.

7.0 Quality Assurance/Quality Control

Quality assurance/quality control (QA/QC) for activities described in this SOP will be attained through a variety of processes, including, at a minimum, the items discussed below. Additional QA/QC requirements, such as audits or field assessments, will be addressed in the governing document referencing this SOP.

7.1 Training

Every effort will be made to ensure quality photographic documentation is gathered to support site activities. Consistency will be achieved to the extent possible through proper training, use of designated field staff, and provision of TL oversight. Any deficiencies or inconsistencies in implementing this SOP noted by the TL will require re-training of the field team members.

7.2 Field Checks

Photographic documentation processes may be checked for completeness and adherence to SOP requirements on a daily basis by the TL for the first week of each field activity. These checks can be extended to once per month as field activities continue, and any errors noticed during the checks will be discussed with the photographer and corrected. If field activities continue beyond six months, the frequency of assessing photographic documentation will be established by the Quality Assurance Manager.

8.0 References

Adapted from CDM Smith Technical Standard Operating Procedure 4-2, Photographic Documentation of Field Activities, January 2012.

Libby Asbestos Superfund Site
Standard Operating Procedure
Control of Measurement and Test Equipment

Prepared by: Terry Crowell Date: 4/12/12
CDM Smith

Approved by: Dania Zinner Date: 4/12/12
EPA Region 8

Revision No.	Date	Reason for Revision
0	4/12/12	--

1.0 Objective

The objective of this standard operating procedure (SOP) is to establish baseline requirements, procedures, and responsibilities for the control of measurement and test equipment (M&TE) used by the U.S. Environmental Protection Agency or its contractors in support of the Libby Asbestos Superfund Site (Libby Site). Additions or modifications to this SOP may be detailed in governing documents referencing this SOP.

2.0 Background

2.1 Definitions

Libby Asbestos Superfund Site (Libby Site) – All buildings and land within the boundaries of the EPA's designated operable units (OUs), as illustrated on the most recent version of the OU boundary map.

Traceability – The ability to trace the history, application, or location of an item and like items or activities by means of recorded identification.

2.2 Discussion

M&TE may be government furnished (GF), rented or leased from an outside vendor, or purchased. It is essential that measurements and tests resulting from the use of equipment be of the highest accountability and integrity. To facilitate that, the equipment shall be used in full understanding and compliance with the instructions and specifications included in the manufacturer's operations and maintenance and calibration procedures, and in accordance with any other related requirements specified in the governing document referencing this SOP.

3.0 Responsibilities

All staff with responsibility for the direct control and/or use of M&TE is responsible for being knowledgeable of, and understanding and implementing the requirements contained herein, as well as any additional related requirements.

Team Leader (TL) – Responsible for identifying the technical specifications (e.g., precision, accuracy) for M&TE needed to meet project data collection objectives, and determining any additional applicable Libby Site-specific requirements (e.g., periodic calibration of primary calibration sources) for M&TE.

Requisitioner – Responsible for ensuring M&TE is obtained or procured that meets the technical specifications identified by the TL, and facilitates obtaining the manufacturer's operations and maintenance and calibration procedures prior to field work.

Receiver – Responsible for receipt and/or unpackaging of M&TE and notifying the TL that the item has been received.

User – Responsible for the proper preparation and use of M&TE to collect the quality and quantity of data needed to meet project objectives. Users are typically field team members.

4.0 Equipment

Required M&TE will be specified in the governing document referencing this SOP.

5.0 Procedures

The following general requirements apply to M&TE at the Libby Site. Additional details and responsibilities are described later in this section.

- Manufacturer maintenance and calibration procedures must be followed when using M&TE
- Obtain the maintenance and calibration procedures if they are missing or incomplete
- Attach or include the maintenance and calibration procedures with the M&TE
- Prepare and record maintenance and calibration in an equipment or field log according to requirements stated in the governing document referencing this SOP
- Maintain M&TE records
- Label M&TE requiring routine or scheduled calibration (when required)
- Perform maintenance and calibration using the appropriate procedure and calibration standards
- Identify and take action on nonconforming M&TE

5.1 Preparation

5.1.1 Obtain the Operating, Maintenance, and Calibration Documents

For Procured M&TE

Requisitioner – Specify that the maintenance and calibration procedures be included.

For GF M&TE Acquired as a Result of Property Transfer

TL – Inspect the M&TE to determine whether maintenance and calibration procedures are included with the item. If missing or incomplete, obtain the appropriate documentation from the manufacturer.

For Rented or Leased M&TE

Requisitioner – Specify that the maintenance and calibration procedures, the latest calibration record, and the calibration standards certification be included. If this information is not delivered with the M&TE, request it from the vendor.

5.1.2 Prepare and Record Maintenance and Calibration Records

For All M&TE

Receiver – Upon receipt of an item of M&TE, notify the TL for the overall property control of the equipment.

TL and User – Record all maintenance and calibration events in an equipment or field log. The log must have sequentially-numbered pages.

5.2 Operation

TL and User – Operate, maintain, and calibrate M&TE in accordance with the maintenance and calibration procedures. Record maintenance and calibration actions in the equipment log or field log.

5.2.2 Traceability of Calibration Standards

For All M&TE

TL and User –

- When ordering calibration standards, request nationally recognized standards as specified or required. Request commercially available standards when not otherwise specified or required. Or, request standards in accordance with other related project-specific requirements.
- Require certifications for standards that clearly state the traceability.
- Require Material Safety Data Sheets to be provided with standards.
- Note standards that are perishable and consume or dispose of them on or before the expiration date.

5.2.3 M&TE That Fails Calibration

For any M&TE item that cannot be calibrated or adjusted to perform accurately:

User – Immediately discontinue use and segregate the item from other equipment.

TL – Review the current and previous maintenance and calibration records to determine if the validity of current or previous measurement and test results could have been affected and notify the appropriate authorities (typically the Project Manager) of the results. Any test results that are known to impact or have the potential to impact project data will be documented using a Libby Field Record of Modification Form.

5.3 Post-operation

M&TE shall be promptly returned to the owner at the end of field activities. All operations, maintenance, and calibration procedures shall be retained with the M&TE. Project M&TE records (e.g., equipment logs) will be retained in the project file.

6.0 Restrictions/Limitations

On an item-by-item basis, exemptions from the requirements of this SOP may be granted by the Health and Safety Manager and/or Quality Assurance Manager. All exemptions shall be documented by the grantor and included in the equipment records as appropriate.

7.0 Quality Assurance/Quality Control

Quality assurance/quality control (QA/QC) for activities described in this SOP will be attained through a variety of processes. Every effort will be made to ensure the appropriate and functional M&TE are used to support site activities. This will be achieved to the extent possible through proper training, use of qualified procurement and designated field staff, and provision of TL oversight. Any deficiencies or inconsistencies in implementing this SOP noted by the TL will require discussion with appropriate management and, as appropriate, re-training of the field team members. Additional QA/QC requirements, such as audits or field assessments, will be addressed in the governing document referencing this SOP.

8.0 References

Adapted from CDM Smith Technical Standard Operating Procedure 5-1, Control of Measurement and Test Equipment, January 2012.

Libby Asbestos Superfund Site
Standard Operating Procedure
Field Equipment Decontamination

Prepared by: ______________ Date: 4/12/12
CDM Smith

Approved by: ______________ Date: 4/12/12
EPA Region 8

Revision No.	Date	Reason for Revision
0	4/12/12	--

1.0 Objective

Decontamination of field equipment is necessary to ensure acceptable quality of samples by preventing cross contamination. Further, decontamination reduces health hazards and prevents the spread of contaminants off site. The objective of this standard operating procedure (SOP) is to establish baseline requirements, procedures, and responsibilities for the decontamination of field equipment used by the U.S. Environmental Protection Agency or its contractors in support of the Libby Asbestos Superfund Site (Libby Site). Additions or modifications to this SOP may be detailed in governing documents referencing this SOP.

2.0 Definitions

Clean – Free of contamination and when decontamination has been completed in accordance with this SOP.

Cross contamination – The transfer of contaminants through equipment or personnel from the contamination source to less contaminated or non-contaminated samples or areas.

Decontamination – The process of rinsing or otherwise cleaning the surfaces of equipment to rid them of contaminants and to minimize the potential for cross contamination of samples or exposure of personnel.

De-mineralized water – Water that has had most to all minerals removed from it. De-mineralized water shall only be stored in clean glass, stainless steel, or plastic containers that can be closed when not in use.

Libby Asbestos Superfund Site (Libby Site) – All buildings and land within the boundaries of the EPA's designated operable units (OUs), as illustrated on the most recent version of the OU boundary map.

Material Safety Data Sheet (MSDS) – Document that discusses the proper storage and physical and toxicological characteristics of a particular substance used during field operations. MSDSs are to be maintained on site at all times during field operations.

Potable water – Tap water may be obtained from any municipal system. Chemical analysis of the water source may be required before it is used.

Sampling equipment – Equipment that comes into direct contact with the sample media. Such equipment includes split spoon samplers, well casing and screens, and trowels or bowls used to collect and/or homogenize samples.

Soap – Low-sudsing, non-phosphate detergent (e.g., Liquinox®).

Solvent rinse – Pesticide-grade (or better) isopropanol, acetone, or methanol.

3.0 Responsibilities

Successful execution of this SOP requires a clear hierarchy of assigned roles with different sets of responsibilities associated with each role. All staff responsible for field equipment decontamination will understand and implement the requirements contained herein, as well as any additional requirements stated in governing documents referencing this SOP.

Team Leader - The TL is responsible for ensuring that field personnel are properly trained and that decontamination is conducted in accordance with this procedure and any other pertinent Libby Site decontamination processes cited in the governing document referencing this SOP.

Field Team Members – Field team members performing operations on the Libby Site are responsible for adhering to the procedures contained in this SOP and any other decontamination processes specified in the governing document referencing this SOP. If required, field team members will collect and document rinsate samples (also known as equipment blanks) to provide quantitative verification that these procedures have been correctly implemented. Field team members are also responsible for communicating any problems pertaining to the decontamination of field equipment to the TL.

4.0 Equipment

The following equipment may be employed wholly or in part during use of this SOP (refer to the governing document referencing this SOP for detailed requirements):

- Stiff-bristle scrub brushes
- Plastic buckets, scoops, trowels, and troughs
- Soap
- Nalgene® or Teflon® sprayers or wash bottles or 2- to 5-gallon, manual-pump sprayers (pump sprayer material must be compatible with the solution used)
- Plastic sheeting, plastic bags, and/or aluminum foil to keep decontaminated equipment clean between uses
- Disposable wipes, rags, or paper towels
- Potable water (potable water may be required to be tested for contaminants before use)
- De-mineralized water
- Gloves, safety glasses, and other protective clothing as specified in the health and safety plan
- High-pressure pump with soap dispenser or steam-spray unit (for large equipment only)
- Appropriate decontamination solutions pesticide grade or better and traceable to a source

- Tools for equipment assembly and disassembly
- 55-gallon drums or tanks for temporary storage of decontamination water
- Pallets for drums or tanks holding decontamination water

5.0 Procedures

All reusable equipment (non-dedicated) used to collect, handle, or measure samples shall be decontaminated before coming into contact with any sample media or personnel using the equipment. Decontamination of equipment shall occur either at a specified location, central decontamination station or at portable decontamination stations set up at the sampling location, drill site, or monitoring well location. The centrally-located decontamination area may include an appropriately-sized bermed and lined area on which equipment decontamination occurs and equipped with a collection system and/or storage vessels. In certain circumstances, berming may not be necessary when small quantities of water are being generated and for some short duration field activities. Equipment shall be transported to and from the decontamination area in a manner to prevent cross contamination of equipment and/or the area.

Typically at the Libby Site, decontamination water will not be captured and will be discharged to the ground at the site. However, the exact procedure for decontamination waste disposal may be discussed in the governing document referencing this SOP. Also, solvent rinse fluids may need to be segregated from other investigation-derived waste (IDW).

All items that come into contact with potentially contaminated media shall be decontaminated before use, between sampling locations (does not need to be performed between aliquots of an individual sample) and/or drilling locations, and after use. All decontamination procedures for the equipment being used are provided in the following sections.

General Guidelines

- Potable or de-mineralized water shall be free of all contaminants of concern. Depending upon the governing document referencing this SOP, analytical data from the water source may be required to ensure it is clean.
- Sampling equipment that has come into contact with oil and grease shall be cleaned with methanol or other approved alternative to remove the oily material. This may be followed by a hexane rinse and then another methanol rinse. Regulatory or Libby Site-specific requirements regarding solvent use shall be stated in the governing document referencing this SOP.
- All solvents[1] shall be pesticide-grade or better and traceable to a source. The corresponding lot numbers shall be recorded in the appropriate field logbook.
- Decontaminated equipment shall be allowed to air dry before being used.
- Documentation of all equipment, including type of equipment, date, time, method of decontamination, and any associated field quality control sampling, shall be recorded in the field logbook.

[1]Solvents are potentially hazardous materials and must be handled, stored, and transported accordingly. Solvents shall never be used in a closed building. See the investigation-specific health and safety plan and/or the chemical's MSDS for specific information regarding the safe use of the chemical.

- Gloves, boots, safety glasses, and any other personnel protective clothing and equipment shall be used as specified in the governing document referencing this SOP and/or health and safety plan.

5.1 Heavy Equipment Decontamination

Heavy equipment typically used at the Libby Site includes drilling rigs, trucks, and excavators. For any heavy equipment used during EPA response actions, the equipment decontamination procedures provided in the current version of the Libby Asbestos Site Response Action Work Plan shall apply. For all other field activities, follow these steps when decontaminating heavy equipment:

1. Establish a bermed decontamination area that is large enough to fully contain the equipment to be cleaned. If available, an existing wash pad or appropriate paved and bermed area may be used; otherwise, use one or more layers of heavy plastic sheeting to cover the ground surface and berms. All decontamination pads shall be upwind of the investigation area(s).
2. With the heavy equipment in place, spray areas (rear of rig or backhoe) exposed to contaminated media by pressurized means. Be sure to spray down all surfaces, including the undercarriage.
3. Use brushes, soap, and appropriate decontamination water to remove dirt whenever necessary.
4. Remove equipment from the decontamination pad.
5. After decontamination activities are completed, collect all plastic sheeting, and disposable gloves, boots, and clothing in containers or receptacles. All receptacles containing contaminated items must be properly labeled for disposal as detailed in the governing document referencing this SOP.

5.2 Downhole Equipment Decontamination

Downhole equipment includes hollow-stem augers, drill pipes, rods, and stems. Follow these steps when decontaminating this equipment:

1. Set up a centralized decontamination area, if possible. This area shall be set up to collect contaminated rinse waters and to minimize the spread of airborne spray.
2. Set up a “clean” area upwind of the decontamination area to receive cleaned equipment for air-drying. At a minimum, clean plastic sheeting must be used to cover the ground, tables, or other surfaces on which decontaminated equipment is to be placed. All decontamination areas shall be upwind of any areas under investigation.
3. Using soap and appropriate water with pressurization (e.g., Hudson® sprayer), spray the contaminated equipment. Aim downward to avoid spraying outside the decontamination area. Be sure to spray inside corners and gaps especially well. Use a brush, if necessary, to dislodge dirt.
4. If using soapy water, rinse the equipment using clean appropriate water with pressurization.
5. Remove the equipment from the decontamination area and place in a clean area upwind to air dry.
6. After decontamination activities are completed, collect all plastic sheeting, and disposable gloves, boots, and clothing in containers or receptacles. All receptacles containing

contaminated items must be properly labeled for disposal as detailed in the governing document referencing this SOP.

5.3 Sampling Equipment Decontamination

Follow these steps when decontaminating sampling equipment:

1. Set up a decontamination line. The decontamination line shall progress from "dirty" to "clean." A clean area shall be established upwind of the decontamination wash/rinse activities to dry the equipment.
2. Disassemble any items that may trap contaminants internally. Do not reassemble the items until decontamination and air drying are complete.
3. Wash the items with appropriate water and soap using a stiff brush as necessary to remove particulate matter and surface films. With the exception of polyvinyl chloride or plastic items, the items may be steam-cleaned using soap and hot water as an alternative to brushing. Items that have come into contact with concentrated and/or oily contaminants may need to be rinsed with a solvent such as hexane and allowed to air dry prior to this washing step.
4. Thoroughly rinse the items with potable water.
5. If sampling for organic compounds, thoroughly rinse the items with solvent (e.g., isopropanol) followed by a rinse using de-mineralized water. The specific chemicals used for the solvent rinse phase shall be specified in the work plan. Solvents are potentially hazardous materials and care must be exercised when using these chemicals to prevent adverse health effects. Appropriate personal protective equipment (PPE) must be worn when using these chemicals. These chemicals (including spent rinsate) must be managed and stored appropriately. Special measures such as proper labels, paperwork, notification, etc. may be required when transporting or shipping solvent chemicals.
6. Rinse the items thoroughly using de-mineralized water.
7. Allow the items to air dry completely.
8. After decontamination activities are completed, collect all plastic sheeting, and disposable PPE. Place the contaminated items in properly labeled bags or containers for disposal. Refer to the governing document referencing this SOP for labeling and waste management requirements.

5.4 Pump Decontamination

Follow the manufacturer’s recommendation for specified pump decontamination procedures. At a minimum, follow these steps when decontaminating pumps:

1. Set up the decontamination area and separate “clean” storage area using plastic sheeting to cover the ground, tables, and other surfaces. Set up three containers: the first container shall contain dilute (non-foaming) soapy water; the second container shall contain potable water; and the third container shall contain de-mineralized water.
2. The pump shall be set up in the same configuration as for sampling. Submerge the pump intake (or the pump, if submersible) and all downhole-wetted parts (tubing, piping, foot valve) in the soapy water of the first container. Pump soapy water through the pump assembly. Scrub the outside of the pump and other wetted parts with a metal brush.

3. Move the pump assembly to the potable water container while leaving discharge outlet in the waste container. All downhole-wetted parts must be immersed in the potable water rinse. Pump potable water through the pump assembly until it runs clear.
4. Move the pump intake to the de-mineralized water container. Pump the water through the pump assembly. Pump the volume of water through the pump specified in the field plan. Usually, three pump-and-line-assembly volumes shall be required.
5. Remove the decontaminated pump assembly to the clean area and allow it to air dry upwind of the decontamination area. Intake and outlet orifices shall be covered to prevent the entry of airborne contaminants and particles.

5.5 Instrument Probe Decontamination

Instrument probes used for field measurements (e.g., pH meters, conductivity meters) shall be decontaminated between samples and after use with de-mineralized water. At no time shall a sample probe be placed in contact with water within a sample container.

5.6 Waste Disposal

Waste disposal should follow the requirements listed in Libby project-specific SOP for handling investigation-derived waste (IDW) and the governing document referencing this SOP. The following are guidelines for disposing of waste:

- Decontamination water will typically not be captured, packaged, labeled, or stored as IDW at the site. Decontamination water will be discharged to the ground at the work site. Other materials used in the decontamination process will be disposed of as IDW.
- Small quantities of decontamination solutions may be allowed to evaporate to dryness.
- If large quantities of used decontamination solutions shall be generated, each type of waste shall be segregated in separate containers.
- Plastic sheeting and disposable protective clothing will be treated and disposed of as asbestos-containing materials.

6.0 Restrictions/Limitations

If the field equipment is not thoroughly rinsed and allowed to completely air dry before use, volatile organic residue, which interferes with the analysis, may be detected in the samples. The occurrence of residual organic solvents is often dependent on the time of year sampling is conducted. In the summer, volatilization is rapid, and in the winter, volatilization is slow. Check with EPA Region 8 and the State of Montana for approved decontamination solvents.

7.0 Quality Assurance/Quality Control

Quality assurance/quality control (QA/QC) for activities described in this SOP will be attained through a variety of processes, including, at a minimum, the items discussed below. Additional QA/QC requirements, such as audits or field assessments, will be addressed in the governing document referencing this SOP.

7.1 Training

Every effort will be made to ensure proper field equipment decontamination, which will be achieved to the extent possible through proper training, use of designated field staff, and provision of TL oversight. Any deficiencies or inconsistencies in implementing this SOP noted by the TL will require staff re-training.

7.2 Field Checks

Adherence to field equipment decontamination requirements may be checked on a daily basis by the TL for the first week of each field activity. These checks can be extended to once per month as field activities continue, and any non-compliance discussed with the field team member. If field activities continue beyond six months, the frequency of assessing field equipment decontamination will be established by the field Quality Assurance Manager.

8.0 References

Adapted from CDM Smith Technical Standard Operating Procedure 4-5, Field Equipment Decontamination, January 2012.

Libby Asbestos Superfund Site
Standard Operating Procedure
Handling Investigation-derived Waste

Prepared by: ______________________ Date: 4/12/12
CDM Smith

Approved by: ______________________ Date: 4/12/12
EPA Region 8

Revision No.	Date	Reason for Revision
0	4/12/12	--

1.0 Objective

The objective of this standard operating procedure (SOP) is to establish baseline requirements, procedures, and responsibilities for handling investigation-derived waste (IDW) resulting from work performed by the U.S. Environmental Protection Agency or its contractors in support of the Libby Asbestos Superfund Site (Libby Site). Additions or modifications to this SOP may be detailed in governing documents referencing this SOP.

2.0 Background

2.1 Definitions

Hazardous Waste – Discarded material that is regulated listed waste, or waste that exhibits ignitability, corrosivity, reactivity, or toxicity as defined in 40 CFR 261.3 or state regulations.

Investigation-derived Waste (IDW) – Discarded materials resulting from field activities such as sampling, surveying, drilling, excavation, and decontamination processes that, in present form, possess no inherent value or additional usefulness without treatment.

Libby Asbestos Superfund Site (Libby Site) – All buildings and land within the boundaries of the EPA's designated operable units (OUs), as illustrated on the most recent version of the OU boundary map.

Site – All buildings (if applicable) and land within the boundaries of the EPA's designated geounits, which may represent individual properties within the Libby Site, a collection of properties, or a larger geographical area.

Treatment, Storage, and Disposal Facility (TSDF) – Permitted facilities that accept hazardous waste shipments for further treatment, storage, and/or disposal. These facilities must be permitted by the EPA and appropriate state and local agencies.

2.2 Discussion

At the Libby Site, field investigation and response action activities may result in the generation of IDW. IDW may include soil and cuttings from test pits or well installation; soil and other materials from the collection of samples; personal protective equipment (PPE); and other wastes or supplies used during the sampling and testing of potentially hazardous materials.

The vast majority of Libby Site IDW is expected to relate to the contaminant of concern – Libby amphibole asbestos. The overall management of IDW must comply with applicable regulatory requirements.

3.0 Responsibilities

Successful execution of this SOP requires a clear hierarchy of assigned roles with different sets of responsibilities associated with each role. All staff responsible for handling IDW will understand and implement the requirements contained herein, as well as any additional requirements stated in governing documents referencing this SOP.

Team Leader (TL) – The TL is responsible for identifying Libby Site-specific requirements for the disposal of IDW in accordance with federal, state, and/or facility requirements, and ensuring that all IDW procedures are conducted in accordance with this SOP. The TL will communicate with the field team members regarding the specific objectives and anticipated situations that require deviation from this SOP.

Field Team Members – Field team members are responsible for adhering to the procedures contained in this SOP, and communicating any unusual or unplanned condition to the TL.

4.0 Equipment

Equipment required for IDW containment may vary according to field activity requirements. Management decisions concerning the necessary equipment required shall consider containment method, sampling, labeling, maneuvering, and storage (if applicable). Equipment must be onsite and inspected before commencing work.

4.1 IDW Containment Devices

The appropriate containment device (e.g., bags, drums, tanks, etc.) and the ultimate disposition of the IDW shall be specified in the governing document referencing this SOP. Typical IDW containment devices include:

- Plastic sheeting (polyethylene) with a minimum thickness of 6 mil
- U.S. Department of Transportation (DOT)-approved steel containers
- Polyethylene or steel bulk storage tanks

The volume of the appropriate containment device shall be specified in the governing document referencing this SOP.

4.2 IDW Container Labeling

A “Waste Container” or “IDW Container” label or indelible marking shall be applied to each container. Labeling or marking requirements for onsite IDW not expected to be transported offsite are as detailed below.

- Labels and markings must contain the following information: project name, generation date, location of waste origin, container identification number, sample number (if applicable), and contents.

- Each label or marking will be applied to the upper one-third of the container at least twice, on opposite sides.

- Containers that are 5 gallons or less may only require one label or set of markings.
- Labels or markings will be positioned on a smooth part of the container. The label must not be affixed across container bungs, seams, ridges, or dents.
- Labels must be constructed of a weather-resistive material with markings made with a permanent marker or paint pen and capable of enduring the expected weather conditions. If markings are used, the color must be easily distinguishable from the container color.
- Labels will be secured in a manner to ensure that they remain affixed to the container.

Labeling or marking requirements for IDW expected to be transported off of the work site must be in accordance with the requirements of 29 CFR 1926.1101.

4.3 IDW Container Movement

Staging areas for IDW containers shall be predetermined and in accordance with investigation-specific requirements. Arrangements shall be made before field mobilization as to the methods and personnel required to safely transport IDW containers to the staging area. Transportation of IDW containers offsite via a public roadway is prohibited unless 49 CFR 172 requirements are met.

4.4 IDW Container Storage

Containerized IDW awaiting results of pending chemical analysis or further onsite treatment shall be staged on site. Staging areas and bulk storage procedures are to be determined according to investigation-specific requirements. Containers are to be stored in such a fashion that the labels can be easily read. A secondary/spill container must be provided for liquid IDW storage and as appropriate for solid IDW storage (e.g., steel drums shall not be stored in direct contact with the ground).

5.0 Procedures

The three general options for managing IDW are: 1) collection and onsite disposal; 2) collection for offsite disposal; and 3) collection and interim management. The option selected shall take into account the following factors:

- Type (soil, sludge, liquid, debris), quantity, and source of IDW
- Risk posed by managing the IDW onsite
- Compliance with regulatory requirements
- IDW minimization and consistency with the Libby Site remedy

5.1 Collection and Onsite Disposal

5.1.1 Soil/Sludge/Sediment

Unless otherwise specified in the governing document referencing this SOP, when handling soil/sludge/sediment IDW at the Libby Site, the following will apply:

- Return IDW to boring, pit, or source immediately after generation as long as returning the media to these areas will not increase site risks (i.e., the contaminated soil will not be in a different area or at a different depth than from where it was originally obtained).

5.1.2 Aqueous Liquids

Unless otherwise specified in the governing document referencing this SOP, options for handling aqueous liquid IDW at the Libby Site are listed below. These options may require results of laboratory analysis to obtain client and/or regulatory approval.

- Discharge to ground surface close to the well from which it was extracted, only if soil contaminants will not be mobilized in the process and the action will not contaminate clean areas. If IDW from the sampling of background up-gradient wells is not a community concern or associated with soil contamination, this presumably uncontaminated IDW may be released on the ground around the well.
- When small amounts (i.e., less than 5 gallons) of used decontamination fluids are generated during site characterization activities (e.g., during soil sampling), the fluids may be discharged to the ground surface within the sampling area or allowed to evaporate from an open bucket.

5.1.3 Disposable PPE

Disposable PPE IDW (not including excess soil volume) for the Libby Site will be collected in garbage bags and marked “IDW” with an indelible ink marker. These bags will be deposited into the asbestos-containing material (ACM) waste stream for appropriate disposal at the local Class IV asbestos landfill. Excess soil volume will be returned to the area from where it was collected.

5.2 Collection and Interim Management

Collection and interim management options that may be employed for Libby Site IDW are provided herein.

Storing IDW onsite until the final action may be practical in the following situations:

- Returning wastes (especially sludges and soils) to their onsite source area would require re-excavation for disposal as determined for the final site remedy.
- Interim storage in containers may be necessary to provide adequate protection to human health and the environment.
- Storing IDW until the final disposal of all wastes from the site will eliminate the need to address this issue more than once.
- Interim storage may be necessary to provide time for sampling and analysis.

6.0 Restrictions/Limitations

Managers of the site shall determine the most appropriate disposal option for IDW an activity-specific basis. Parameters to consider, especially when determining the level of protection, include: the volume of IDW and the nature of contaminants present in the site soil. Special disposal/handling may be needed for drilling fluids because they may contain significant solid components and therefore may need to be handled, treated, and disposed as non-liquid waste. Disposable sampling materials, disposable PPE, decontamination fluids, etc. will always be managed on a site-specific basis. Under no circumstances shall these types of materials be stored in a site office, facility, or warehouse.

7.0 Quality Assurance/Quality Control

Quality assurance/quality control (QA/QC) for activities described in this SOP will be attained through a variety of processes, including, at a minimum, the items discussed below. Additional QA/QC requirements, such as audits or field assessments, will be addressed in the governing document referencing this SOP.

7.1 Training

Every effort will be made to ensure proper handling of IDW, which will be achieved to the extent possible through proper training, use of designated field staff, and provision of TL oversight. Any deficiencies or inconsistencies in implementing this SOP noted by the TL will require staff re-training.

7.2 Field Checks

Adherence to requirements for handling IDW may be checked on a daily basis by the TL (or their designate) for the first week of each field activity. These checks can be extended to once per month as field activities continue. Any deficiencies or inconsistencies in implementing this SOP noted by the TL will require field team member re-training. If field activities continue beyond six months, the frequency of assessing field logbook entries will be established by the field Quality Assurance Manager or their designate.

8.0 References

Adapted from CDM Smith Technical Standard Operating Procedure 2-2, Guide to Handling Investigation-derived Waste, January 2012.

Libby Asbestos Superfund Site Standard Operating Procedure Sample Custody

Prepared by: Terry Crowell
CDM Smith

Date: 4/12/12

Approved by: Dania Zinner
EPA Region 8

Date: 4/12/12

Revision No.	Date	Reason for Revision
0	4/12/12	--

1.0 Objective

Sample custody procedures are integral to maintaining and documenting the possession of environmental samples collected by the U.S. Environmental Protection Agency or its contractors in support of the Libby Asbestos Superfund Site (Libby Site). The objective of this standard operating procedure (SOP) is to establish baseline requirements, procedures, and responsibilities for sample custody for the Libby Site. Additions or modifications to this SOP may be detailed in governing documents referencing this SOP.

2.0 Background

2.1 Definitions

Chain-of-custody record (COC) – Used to document the custody, control, transfer, analysis, and disposition of samples.

Custody seal – An adhesive-backed seal that is applied to an individual sample or sample container to demonstrate that sample integrity has not been compromised during sample transfer.

Facility – A designated sample processing facility, analytical laboratory, or long-term storage area, for Libby Site samples.

Field sample data sheet (FSDS) – A controlled document used to record sample information.

Libby Asbestos Superfund Site (Libby Site) – All buildings and land within the boundaries of the EPA's designated operable units (OUs), as illustrated on the most recent version of the OU boundary map.

Sample – Material to be analyzed that is contained in single or multiple containers representing a unique sample number.

Sample custody – The possession or safe-keeping of samples in such a manner that prevents tampering, damage, or loss.

Sample labels – Adhesive-backed labels that contain, at a minimum, the unique sample number/identifier. Sample labels are typically used on field documentation, sample cassettes, and containers, and may be pre-printed to minimize sequencing or transcription errors.

2.2 Discussion

Because of the evidentiary nature of samples collected during environmental investigations, possession must be traceable from the time the samples are collected until their derived data are introduced as evidence in legal proceedings. To maintain and document sample possession, sample custody procedures must be followed.

3.0 Responsibilities

Successful execution of this SOP requires a clear hierarchy of assigned roles with different sets of responsibilities associated with each role. All staff responsible for the custody of samples will understand and implement the requirements contained herein, as well as any additional requirements stated in governing documents referencing this SOP.

<u>Team Leader (TL)</u> – Responsible for ensuring that strict chain-of-custody procedures are maintained during all sampling events.

<u>Sampler</u> – Responsible for the care and custody of samples from the time of collection until they are transferred.

<u>Field Sample Coordinator (FSC)</u> – Responsible for accepting samples into their custody from the sampler(s), producing COCs, and relinquishing or shipping samples to the appropriate facility.

<u>Laboratory Coordinator (LC)</u> – Responsible for coordinating the preparation and/or analysis of Libby Site samples with project facilities in order to achieve requested turnaround times for analytical data.

4.0 Equipment

Depending upon staff responsibility, the following equipment will be employed during use of this SOP:

- Field logbook
- FSDSs
- Indelible blue or black ink pens
- Sample labels
- Zip-top plastic bags
- Custody seals
- Container(s) in which to keep/protect samples

5.0 Procedures

5.1 Preparation

Communications between the TL, sampler(s), the FSC, the LC are critical to ensure the efficient throughput of samples to meet project data objectives. As such, an FSC will attend all field planning meetings to gather information about sampling events (e.g., sample quantities, special sample handling, processing, or analysis concerns, and requested turnaround times). For long-term field programs, sampling staff will notify the FSC daily of the estimated number and type of samples to be collected. In either case, the FSC will relay the pertinent investigation-specific information to the LC, who will, in turn, coordinate preparation and/or analysis with project facilities. On an as-needed basis (typically daily during the field season), the FSC will schedule meetings in which to relinquish samples to the LC.

5.2 Operation

A sample is under custody if it is: 1) in your possession, 2) in your view after being in your possession, 3) in your possession and you locked it up, or 4) in a designated secure area. The following procedures detail the process used to maintain the custody of each Libby Site sample. Note that if at any point samples are left unattended or receipt of samples is refused, this must be documented in the field logbook or on the COC, as appropriate.

5.2.1 Sampler Custody

Sample custody begins at the time of sample collection and will be maintained using a field logbook and FSDSs to document pertinent sample-related information. Samples will be placed in safe areas where they are protected from tampering, damage, or loss. Following sample collection, custody seals will be used as an indicator of tampering. Samples will remain in the sampler's possession, within sight, or in a secure area (e.g., locked vehicle) until the sample is relinquished.

For samples collected using zip-top bags as the primary container, all samples will be double-bagged and custody sealed on the outer bag by the sampler. For samples collected using cassettes, the cassette will be custody sealed so that both end caps of the sampling cassette are covered but sample labels or identifiers are not obstructed. The cassette will then be placed in a zip-top bag.

Sampler(s) may be required to transfer custody of samples directly to an FSC or a designated secure sample storage location, or to hand deliver or ship samples to a facility – refer to the governing document referencing this SOP for specifics. Project-specific SOP EPA-LIBBY-2012-07, *Packaging and Shipping Environmental Samples*, will be followed for samples that are required to be shipped.

If relinquishing to an FSC or secure storage area, the sampler will note in the field logbook the time of transfer, and the name and company affiliation of the receiver or dedicated storage location. Completed and quality-checked FSDSs will accompany the samples.

5.2.2 FSC Custody

Upon receipt of samples and accompany FSDSs, the FSC will verify that:

- Each FSDS is complete
- Each sample is accounted for
- Soil samples are double-bagged
- Each cassette is sealed in its own zip-top bag and caps on cassettes are in place
- Sample containers (e.g., bags, bottles) are tightly sealed
- Custody seals are correctly and securely placed on each sample
- Samples appear to be in an acceptable condition (i.e., cassettes are not cracked; sample containers are not leaking, etc.).
- No information is provided on the sample or sample container that would disclose the origin of the sample to the facility

The FSC will immediately contact the sampler if any acceptance issues are encountered. Once accepted, the FSC will prepare a COC using EPA-specified data management tools (e.g., Data Entry Tool, Scribe). An investigation-specific Analytical Summary Sheet (available in the SAP or Libby Field eRoom) will be attached to the COC. The FSC will group or batch the appropriate number of individual samples on a COC to facilitate data reporting, or as otherwise requested by the LC.

The following general batching guidelines will be used for commonly sampled Libby Site media:

- 10 or fewer non-clearance air samples on one COC
- one set of five clearance air samples and two corresponding field blanks on one COC
- 20 or fewer soil or soil-like (e.g., duff, wood chip) samples on one COC
- 10 or fewer dust samples on one COC

Following coordination with the LC, the FSC will hand deliver or ship samples (following project-specific SOP EPA-LIBBY-2012-07, *Packaging and Shipping Environmental Samples*) to the designated facility. All samples will be maintained in a secure location by the FSC until they are relinquished to another party.

5.3 Post-operation

Sample documentation (logbooks, FSDSs, field copy of the COC, etc.) will be maintained in accordance with Libby Site data management requirements and any special requirements stated in the governing document referencing this SOP (e.g., posting to an eRoom).

6.0 Restrictions/Limitations

For EPA Contract Laboratory Program sampling events, combined chain-of-custody/traffic report forms generated with Scribe or other EPA-specific records may be used. Refer to EPA regional guidelines for completing these forms. Scribe software may be used to customize sample labels and custody records when directed by the client.

7.0 Quality Assurance/Quality Control

Quality assurance/quality control (QA/QC) for activities described in this SOP will be attained through a variety of processes, including, at a minimum, the items discussed below. Additional QA/QC requirements, such as audits or field assessments, will be addressed in the governing document referencing this SOP.

7.1 Training

Every effort will be made to ensure proper sample custody from the point of collection to final disposition. Sample custody will be maintained to the extent possible through proper training, use of designated field staff, and provision of TL oversight. Any deficiencies or inconsistencies in implementing this SOP noted by the TL will require staff re-training.

7.2 Field Checks

Field checks for adherence to this SOP may be performed on a daily basis by the TL for the first week of each field activity. These checks can be extended to once per month as field activities continue. Any non-compliance issues will be discussed with field personnel and corrected. If field activities continue beyond six months, the frequency of assessing sample custody procedures will be established by the field Quality Assurance Manager.

8.0 References

Adapted from CDM Smith Technical Standard Operating Procedure 1-2, Sample Custody, January 2012.

Libby Asbestos Superfund Site
Standard Operating Procedure
Packaging and Shipping Environmental Samples

Prepared by: Terry Crowell Date: 4/12/12
CDM Smith

Approved by: Dania Zinner Date: 4/12/12
EPA Region 8

Revision No.	Date	Reason for Revision
0	4/12/12	--

1.0 Objective

The objective of this standard operating procedure (SOP) is to establish baseline requirements, procedures, and responsibilities for the packaging and shipping of environmental samples collected by the U.S. Environmental Protection Agency or its contractors in support of the Libby Asbestos Superfund Site (Libby Site). Sections 2.0 through 7.0 of this SOP outline requirements for the packaging and shipping of regulated environmental samples under the U.S. Department of Transportation (DOT) Hazardous Materials Regulations, the International Air Transportation Association (IATA), and International Civil Aviation Organization (ICAO) Dangerous Goods Regulations (for shipment by air) and applies only to domestic shipments.

This SOP does not cover the requirements for packaging and shipment of equipment or bulk chemicals that are regulated under the DOT, IATA, and ICAO, nor does it address shipment of hazardous materials. Hazardous material will not be shipped unless personnel have received training that meets the requirements of the governing agency and the DOT.

Additions or modifications to this SOP may be detailed in governing documents referencing this SOP.

2.0 Background

2.1 Definitions

Bottle ware – Plastic or glass bottles or jars used to contain sampled material. Their purpose is to keep sampled material from mixing with the ambient environment.

Chain-of-custody record (COC) – Used to document the custody, control, transfer, analysis, and disposition of samples.

Custody seal – An adhesive-backed seal that is applied to an individual sample or sample container to demonstrate that sample integrity has not been compromised during sample transfer.

Environmental sample – An aliquot of air, water, plant material, sediment, or soil that represents potential contaminant levels at a site. This procedure applies only to environmental samples that contain less than reportable quantities for any foreseeable hazardous constituents according to DOT regulations promulgated in 49 CFR - Part 172.101 Appendix A.

Facility – A sample processing facility, analytical laboratory, or long-term storage area that serves as the receiver for Libby Site samples.

Excepted quantity – Excepted quantities are limits to the mass or volume of a hazardous material in the sample containers below which DOT, IATA, ICAO regulations do not apply. The excepted quantity limits are very low. Most regulated shipments will be made under limited quantity.

Libby Asbestos Superfund Site (Libby Site) – All buildings and land within the boundaries of the EPA's designated operable units (OUs), as illustrated on the most recent version of the OU boundary map.

Limited quantity – Limited quantity is the maximum amount of a hazardous material below which there are specific labeling or packaging exceptions.

Performance testing – Performance testing is the required testing of outer packaging. These tests include drop and stacking tests.

Qualified Shipper – A qualified shipper is a person who has been adequately trained to perform the functions of shipping hazardous materials.

Site – All buildings (if applicable) and land within the boundaries of the EPA's designated geounits, which may represent individual properties within the Libby Site, a collection of properties, or a larger geographical area.

2.2 Discussion

Proper packaging and shipping is necessary to ensure the integrity of environmental samples during transport. These shipments are potentially subject to regulations published by DOT, IATA, or ICAO. Failure to abide by these rules places both the governing agency and the individual employee at risk of serious fines.

3.0 Responsibilities

Successful execution of this SOP requires a clear definition of assigned roles and responsibilities. All staff responsible for packaging or shipping Libby Site environmental samples will understand and implement the requirements contained herein, as well as any additional requirements stated in governing documents referencing this SOP.

Team Leader (TL) – Responsible for overseeing sample packaging and shipping processes as described in this SOP.

Packager/Shipper – Party (typically the Field Sample Coordinator or Sampler) responsible for properly packaging and shipping samples to the designated project facility.

Qualified Shipper – Responsible for ensuring that samples undergoing shipment contain no other contaminant that meets the definition of "hazardous material" as defined by DOT, and for determining the amount of preservative in each sample so that accurate determination of quantities can be made.

4.0 Equipment

4.1 Environmental Samples without Preservatives

The following equipment will be used when packaging and shipping Libby Site samples:

- Shipping containers (e.g., insulated cooler for limited quantities, a sturdy box for air samples)
- Bubble wrap or other space filler
- Heavy-duty plastic garbage bags
- Plastic zip-top bags
- Custody seals
- Clear packaging tape
- Completed chain-of-custody record
- Duct tape
- Completed shipping label
- Completed return address label (for return of coolers)

Vermiculite, shredded paper, expanded polystyrene, or other absorbent material will not be used for packaging or shipping Libby Site samples. Plastic bubble wrap and ice (as required) is acceptable packing material.

4.2 Environmental Samples with Preservatives

In addition to the equipment listed in Section 4.1, the following additional equipment is required when packaging samples containing preservatives:

- Sample containers
- Insulated coolers
- ice packs/bags or “blue ice”
- Sample labels
- Nitrile gloves

5.0 Procedures

5.1.1 Preparation

Considerations that must be made prior to shipping samples include selecting the appropriate shipping option (e.g., overnight delivery) so that analytical holding times for the samples are not exceeded; packaging samples in time to meet courier or shipping service pick-up times; and making arrangements with the project facility regarding Saturday receipt of samples.

5.2 Operation

5.2.1 Solid Media Samples without Preservatives

The following processes will be employed by the Packager/Shipper for non-preserved, solid media samples (soil, duff, bark, bulk material), and samples collected on cassettes (air, dust). Section 5.2.2 provides procedures for packaging and shipping aqueous samples (groundwater, surface water), or samples with aqueous content (sediment, sludge). Due to the potential for cross contamination, samples collected on cassettes must not be shipped in the same container as solid media samples. Refer to the guidance document referencing this SOP for temperature control requirements (ice).

1. Verify the samples undergoing shipment meet the definition of an “environmental sample” and are not a hazardous material as defined by DOT. Professional judgment and/or consultation with qualified persons such as the Health and Safety Manager shall be observed.
2. Select a sturdy shipping container. Ensure that coolers are in good repair. Air and dust samples must be shipped in separate containers from solid media samples.
3. Place samples into the shipping container. During placement, ensure custody seals are securely in place and verify the contents of the shipping cooler against the COC. The COC shall reflect only those samples within the shipping container.
4. Fill all remaining space with bubble wrap or other appropriate space filler, to prevent the sample(s) from being jostled.
5. After the COC has been signed and dated (time included), retain the field copy of the COC. If using a cooler, place the following items into a zip-top plastic bag for inclusion in the cooler: the top two copies of the COC, an analytical parameters table (if applicable), a copy of the investigation-specific analytical requirements summary sheet (applicable to any asbestos analysis), a completed return shipping label for return of the cooler, and any additional contact, results distribution, or billing information. Tape the sealed zip-top bag to the inside of the cooler lid and securely close. If using a box, include all aforementioned documentation inside the box along with the samples.
6. Attach a completed custody seal across the opening of the shipping container on opposite sides. If using a cooler, the cooler lid shall be secured with tape by wrapping each end of the cooler a minimum of two times. The tape shall be affixed to the cooler so that only half of the custody seal is covered, preventing the cooler from being opened without breaking the seal.
7. Secure the completed shipping form to the shipping container. Schedule the container for pickup or drop off at shipper.
8. Once the container is shipped, notify the laboratory of the shipment number and anticipated arrival date/time.

5.2.2 Aqueous or Aqueous-content Samples without Preservatives

This process below will be employed by the Packager/Shipper for non-preserved, aqueous (or aqueous content) samples collected in bottle ware (water, sediment, sludge). Refer to the guidance document referencing this SOP for temperature control requirements (ice).

1. Verify the samples undergoing shipment meet the definition of an “environmental sample” and are not a hazardous material as defined by DOT. Professional judgment and/or consultation with qualified persons such as the Health and Safety Manager shall be observed.
2. Be sure the caps on all bottles are tightened to prevent leaking. Ensure custody seals are securely in place.
3. For glass containers, wrap each container in bubble wrap and secure with waterproof tape to prevent breakage.
4. Place each plastic or bubble-wrapped glass container into a zip-top bag. Smaller glass containers, such as 40-milliliter vials, may be wrapped together for the same sample.
5. Remove as much trapped air when sealing the bag.

6. Select a sturdy cooler in good repair. To control contents: duct tape closed any interior drain plugs from the inside; duct tape closed any exterior drain plugs from the outside; and line the cooler with two large heavy-duty plastic garbage bags.
7. Place the samples into the cooler with sufficient space to allow for the addition of packing material between the samples. It is preferable to place glass sample bottles and jars into the cooler vertically (glass containers are less likely to break when packed vertically rather than horizontally). During placement, verify the contents of the shipping cooler against the COC. The COC shall reflect only those samples within the cooler.
8. Fill all remaining space with bubble wrap or other appropriate space filler to prevent the sample(s) from being jostled.
9. After the COC has been signed and dated (time included), retain the field copy of the COC. Place the following items into a zip-top plastic bag for inclusion in the cooler: the top two copies of the COC, an analytical parameters table (if applicable), a copy of the Analytical Summary Sheet as provided in the governing document referencing this SOP (only applicable to asbestos analysis), a completed return shipping label for return of the cooler, and any additional contact, results distribution, or billing information. Tape the sealed zip-top bag to the inside of the cooler lid and securely close.
10. Fill all remaining space between the samples with packing material. Remove excess air from garbage bags and seal each bag by securely taping the opening closed and then applying a custody seal on the outermost bag.
11. Attach a completed custody seal across the opening of the cooler on opposite sides. The cooler lid shall be secured with tape by wrapping each end of the cooler a minimum of two times. The tape shall be affixed to the cooler so that only half of the custody seal is covered, preventing the cooler from being opened without breaking the seal.
12. Secure the completed shipping form to the shipping container. Schedule the container for pickup or drop off at shipper.
13. Once the container is shipped, notify the laboratory of the shipment number and anticipated arrival date/time.

5.2.3 Samples Requiring Temperature Controls

If temperature controls (i.e., ice) are required (refer to the guidance document referencing this SOP), in addition to the procedures listed in Section 5.2.1 (for solid media samples) or Section 5.2.2 (for aqueous samples), the Packager/Shipper will:

1. Duct tape closed any drain plugs (inside and outside) and line the cooler with two large heavy-duty plastic garbage bags. (This step will already have been performed for aqueous/aqueous-content samples.)
2. Place ice in one-gallon plastic zip-top bags and properly seal the bags.
3. Place bags of ice on top of and between the samples to ensure adequate temperature controls during transport.
4. Ensure a temperature blank is secured inside the cooler.

5.2.4 All Samples with Preservatives

Prior to shipping samples with preservatives, the Qualified Shipper will determine the amount of preservative in each sample. Excepted quantities of preservatives are provided in the following table:

Excepted Quantities of Preservatives

Preservative		Desired in Final Sample		Quantity of Preservative (ml) for Specified Container				
5 drops = 1 ml		**pH**	**Conc.**	**40 ml**	**125 ml**	**250 ml**	**500 ml**	**1 L**
NaOH	30%	>12	0.08%	--	0.25	0.5	1	2
HCl	2N	<1.96	0.04%	0.2	0.5	1	--	--
HNO_3	6N	<1.62	0.15%	--	2	4	5	8
H_2SO_4	37N	<1.15	0.35%	0.1	0.25	0.5	1	2

Conc. = concentration
ml = milliliters
% = percent
L = liter

NaOH = sodium hydroxide
HCl = hydrochloric acid
HNO_3 = nitric acid
H_2SO_4 = sulfuric acid

In addition to the steps outlined in the appropriate section above for the specific media sampled, these additional steps are to be followed when packaging limited-quantity sample shipments:

1. Nitrile gloves are to be worn by anyone handling the sampling containers.
2. All sample containers will be labeled with the sample number and what preservative is being used. Protect the labels with waterproof tape. At a minimum the sample label must contain:

   - Sample number
   - Project or Case number
   - Date and time of sample collection
   - Preservative
   - Analysis

The FSDS will be used to collect all other sample information.

3. The Packager/Shipper will ensure a trip blank(s) is secured inside the cooler(s).
4. The maximum weight of the cooler shall not exceed 30 kg (66 lbs) for any limited-quantity shipment of dangerous goods.

5.3 Post-operation

Shipping documentation will be maintained by the Packager/Shipper to confirm that shipments have been delivered and accepted by the receiver.

6.0 Quality Assurance/Quality Control

Quality assurance/quality control (QA/QC) for activities described in this SOP will be attained through a variety of processes, including, at a minimum, the items discussed below. Additional QA/QC requirements, such as audits or field assessments, will be addressed in the governing document referencing this SOP.

6.1 Training
Every effort will be made to ensure proper sample custody from the point of collection to final disposition. Sample custody will be maintained to the extent possible through proper training, using designated field staff, and providing TL oversight. Any deficiencies or inconsistencies in implementing this SOP noted by the TL will require staff re-training.

6.2 Field Checks
Field checks for adherence to this SOP may be performed on a daily basis by the TL (or their designate) for the first week of each investigation. These checks can be extended to once per month as investigation activities continue, and any errors noticed during the checks will be discussed with field personnel and corrected. If investigation activities continue beyond six months, the frequency of assessing sample packaging and shipping procedures will be established by the field Quality Assurance Manager or their designate.

7.0 References
Adapted from CDM Smith Technical Standard Operating Procedure 2-1, Packaging and Shipping Environmental Samples, January 2012.

Libby Asbestos Superfund Site Standard Operating Procedure Air Sample Collection

Prepared by: Terry Crowell Date: 4/9/12
CDM Smith

Approved by: Dania Zinner Date: 4/9/12
EPA Region 8

Revision No.	Date	Reason for Revision
0	4/6/12	Includes elements from previous Libby SOPs EPA-LIBBY-01 (*Sampling of Asbestos Fibers in Air*) and CDM-LIBBY-14 (*Stationary Air Sample Collection*) to present a unified, updated approach to collecting Libby Site air samples.

1.0 Objective

The objective of this standard operating procedure (SOP) is to establish baseline requirements, procedures, and responsibilities for performing air sampling by the U.S. Environmental Protection Agency or its contractors in support of the Libby Asbestos Superfund Site (Libby Site). Modifications to this SOP may be detailed in governing documents referencing this SOP.

2.0 Background

2.1 Definitions

DryCal® – A type of air flow meter used at the Libby Site as a primary flow standard for calibrating rotameters.

Field sample data sheet (FSDS) – A controlled document used to record sample information.

Inert tubing – Inert tubing (e.g., Tygon®) is used in the sampling train to connect the outflow end of the sample cassette to the sampling pump.

Libby Asbestos Superfund Site (Libby Site) – All buildings and land within the boundaries of the EPA's designated operable units (OUs), as illustrated on the most recent version of the OU boundary map.

Personal air sample – An air sample collected within the breathing zone of the individual being sampled.

Phase contrast microscopy (PCM) sample cassette – A 25-millimeter (mm), three-piece cassette with a 50mm electronically conductive extension cowl loaded with a 0.8 micron pore size, mixed cellulose ester (MCE) filter.

Rotameter – A type of air flow meter.

Sample labels – Adhesive-backed labels that contain, at a minimum, the unique sample number/identifier. Sample labels are typically used on field documentation, sample cassettes, and containers, and may be pre-printed to minimize sequencing or transcription errors.

Sampling pump – A device used to pull air through a filter medium at an established rate. Common pumps used at the Libby Site are the SKC Airchek Sampler, Model 224-PCXR4 (low-volume battery-powered sampling pump) and the Gast 1532 rotary vane pump (high-volume alternating current sampling pump).

Sampling stands – Telescoping tripods designed to hold sample cassettes at a desired height and isolate them from the vibrations of the sampling pump.

Site – All buildings (if applicable) and land within the boundaries of the EPA's designated geounits, which may represent individual properties within the Libby Site, a collection of properties, or a larger geographical area.

Stationary (ambient) air sample – An air sample collected from a fixed location.

2.2 Discussion

Air sampling generally consists of using sampling pumps to draw air over a sample filter for a pre-determined volume in order to measure airborne quantities or concentrations of asbestos fibers. Air sample data serves many purposes at the Libby Site – samples may be investigatory in nature, be used to determine compliance with Occupational Safety and Health Administration requirements, or measure attainment of action levels or cleanup criteria established by EPA to evaluate response actions. Documents governing air sampling activities shall specify the intended use of the air sampling data.

3.0 Responsibilities

Successful execution of this SOP requires a clear hierarchy of assigned roles with different sets of responsibilities associated with each role. All staff responsible for collecting air samples will understand and implement the requirements contained herein, as well as any additional requirements stated in the governing document referencing this SOP.

Team Leader (TL) – The TL is responsible for overseeing air sample collection processes as described in this SOP. The TL is also responsible for checking all work performed and verifying that the work satisfies the objectives of the data collection effort. It is also the responsibility of the TL to communicate the need for any deviations from the SOP with the appropriate personnel, and document the deviation using a Libby Field Record of Modification Form.

Field Team Members – Field team members performing air sampling are responsible for adhering to the procedures contained in this SOP. The field team members should have limited discretion with regard to collection procedures but should exercise judgment regarding the exact locations of samples within the specified sampling area. Field team members are also responsible for communicating any sample collection issues (e.g., equipment failure) to the TL for the purpose of troubleshooting and information-sharing with other field team members.

4.0 Equipment

The following equipment is required for Libby Site air sampling:

- Sampling pump
- PCM sample cassettes
- Sampling stands
- Inert tubing
- Rotameter
- DryCal®
- Sample labels
- Pint-sized plastic zip-top bags
- Cooler or other rigid container
- Custody Seals
- Small standard screwdriver (used to adjust the flow rate in low-volume pumps)
- Field logbooks
- FSDSs
- Indelible blue or black ink pens

5.0 Procedures

Prior to conducting work at any Libby work site, health and safety procedures, as specified in the governing health and safety plan, will be reviewed and the appropriate personal protective equipment donned.

5.1 Preparation

5.1.1 Calibrating the Rotameter with an Electronic Calibrator

Rotameters used for pump calibration are calibrated to a primary flow standard on a quarterly basis. The primary flow standard in use at the Libby Site is the DryCal® DC-Lite, manufactured by Bios International Corporation. Procedures for rotameter calibration with the DC-Lite flow meter are as follows:

1. Obtain the actual temperature and pressure in Libby, Montana from the local National Oceanic and Atmospheric Administration (NOAA) weather station. Record actual temperature and pressure in the fields provided on the Precision Rotameter Calibration Data Sheet (Attachment 1).
2. Set up the calibration train as shown in EPA SOP #2015 (EPA 1994), Figure 4, with the sampling pump, rotameter, and primary flow meter (Attachment 2).
3. The rotameter will be held perpendicular to the plane of the table in a vertical position.
4. Turn the DC-Lite and sampling pump on.
5. Turn the flow adjustment screw or knob on the pump until the desired flow rate is attained.
6. Calibrate rotameter to desired ball reading, as read from the middle of the flow ball, with a sampling pump and sample cassette in-line. The cassette used for calibration must be the same type and from the same lot of sample cassettes that will be used for sampling. Record value in the ball reading column on the rotameter calibration data sheet.

7. Check adjusted flow rate of sampling pump to the DC-Lite flow calibrator primary flow standard. Ten repetitive flow measurements will be averaged and that result recorded in the flow rate column for the selected interval.
8. Repeat this process at 10 intervals over the range of the precision rotameter.
9. Input data into rotameter calculation sheet to generate the corrected flow rate.

5.1.2 Flow Rates and Sample Volume

In general, air samples will be collected using flow rates ranging between 1.0 and 10.0 liters per minute (L/min), with a minimum total sample volume of 1,200 liters. Flow rates will be set at the discretion of the field team member in order to capture, at a minimum, 80 percent (%) of the workday. The sampling pump will provide a non-fluctuating air flow through the filter, and will maintain the initial volume flow rate to within ±10% throughout the sampling period. If at any time the measurement indicates that the flow rate has increased or decreased by more than 10% of the set flow rate, sample collection will cease and the sample will be voided.

In no case will a sample be collected at a flow rate lower than 1.0 L/min, since the linear flow velocity would fall below 4 centimeters per second (cm/sec), which is the minimum velocity specified by the International Organization for Standardization (ISO) method 10312 (ISO 1995) that is used for Libby project air samples.

As samples are initially collected during the sampling event and analyzed, flow rates and sample times may be adjusted to ensure the loading on the sample filter facilitates reaching the required sensitivity goals (i.e., to prevent filter overloading). Filter loading is discussed in more detail in Section 5.2.2 of this SOP.

5.1.3 Calibrating the Sampling Pump with a Rotameter

Each sampling pump will be calibrated before and after each sampling event with a primary or secondary calibration device as described below. This is to ensure that each sampling pump is operating to project requirements as stated in Section 5.2.

The procedures used for sampling pump calibration are as follows:

1. Set up the calibration chain as shown in EPA SOP #2015 (EPA 1994), Figure 5 (Attachment 3) using a rotameter, sampling pump, and a representative sample cassette. The sample cassette to be used for sampling is installed between the pump and the calibrator.
2. To set up the calibration train, attach one end of tubing to the sample cassette base, then attach the other end of the tubing to the inlet plug on the pump. Another piece of tubing is attached from the sample cassette cap to the rotameter.
3. The flow meter should be held in a vertical position.
4. Turn the sampling pump on.
5. Turn the flow adjustment screw or knob on the manifold regulating air flow to the samples until the middle of the float ball on the rotameter is lined up with the pre-calibrated flow rate value.

Each rotameter used for field calibration will be transported to and from each sampling location in a sealed zip-top plastic bag.

5.1.4 Collecting Multiple Samples using One Pump

A sampling pump equipped with more than one manifold may be used to collect more than one sample at a time. In the case two samples will be collected from one pump, calibration must be checked after each alteration of the flow regulators. For example: Turn the knob on (manifold A) until the middle of the float ball on the rotameter is at the desired flow rate value. Turn the knob on (manifold B) until the middle of the float ball on the rotameter is at the desired flow rate value. Verify the calibration of (manifold A), adjust as required. This process must be repeated until both (manifold A) and (manifold B) are at the desired flow rate.

5.2 Operation

5.2.1 Air Sampling Locations

If not specifically discussed in the governing document referencing this SOP, the location of each stationary air sample will be determined by field personnel based on site-specific conditions (e.g., personnel breathing zone, near equipment, soil excavation boundaries, etc.).

5.2.2 Sample Collection Protocol

Each air sample will be collected according to the following procedures:

1. Place a sample label on the sample cassette. Place the corresponding sample label on the FSDS.
2. Determine proper sample location. For a fixed air monitor, this will generally be at a height that represents the breathing zone of the potentially exposed population (e.g., 4-6 feet above the ground or floor). For personal air monitoring, the cassette will typically be placed on the lapel just below the face of the individual being monitored.
3. Set up the sampling train and attach the air intake hose to the sample cassette base. Follow calibration procedures listed in Section 5.1.3. The sample cassette will be positioned such that it is held facing downwards at an approximate 45 degreee angle to avoid any particles entering the filter by precipitation. Remove the sample cassette cap and turn the sampling pump on.
4. Record all pertinent information on the FSDS.
5. Unless otherwise specified in the governing document referencing this SOP, check the sampling pump at a minimum of every 4 hours. If the sample filter darkens in appearance or if loose dust is observed inside the cassette, the sample period will be terminated and the remaining steps below followed to complete collection of the sample. The loading observations will be noted on the FSDS in the comment section.
6. At the end of the sampling period, attach the sample cassette cap with the flow meter device inserted according to the appropriate sampling train. Do not remove the sampling cassette from the sampling train.
7. Collect the post-sampling flow rate with the rotameter. Turn the pump off.
8. Record the stop date and time.
9. Record the post-sampling flow rate.

10. Remove the tubing from the sample cassette. Holding the sample cassette upright, replace the inlet plug on the sample cassette cap and the outlet plug on the sample cassette base. Do not put sample cassettes in shirt or coat pockets as the filters can pick up fibers.
11. Sign and date custody seal and wrap it around both ends of the sample cassette. The custody seal should not cover the sample label.
12. Place each sample cassette in a half-quart sized plastic zip-top sample bag. Each bag should be marked with indelible ink indicating the sample number.

5.2.3 Pump Failure Procedures

If a sampling pump faults prior to the total desired run time, the following procedures will be used:

1. Record the time of the observed pump fault in the comments section of the FSDS.
2. If using a SKC low-volume pump, record the total sample time (in minutes) from the pump counter and note accordingly in the comments section of the FSDS sheet, then add total minutes collected to the start time and document the actual stop time in the stop time section of the FSDS.
3. If no minutes appear on the pump counter, void the sample and recollect as specified by the governing document referencing this SOP, or as directed by the TL or health and safety representative.
4. If time allows, change out the pump and restart sampling. Turn the sampling pump back on and calibrate as required (Section 5.1.3) until desired sample volume requirements are met.

5.3 Post-operation

Non-disposable air sampling equipment will be decontaminated according to instructions provided in the governing document referencing this SOP. In general, sampling pumps and tubing will be wet-wiped prior to and following sample collection. Dispose of the wipes as IDW.

Sample custody, and any packaging and shipping requirements, for Libby Site samples will be specified in the governing document referencing this SOP. Project documentation (field logbook, FSDS) will be retained according to data management requirements and/or in the project file.

6.0 Restrictions/Limitations

High levels of dust or other suspended particulates in air may clog or overload the sample filter and reduce the ability to observe and characterize asbestos fibers on the filter. Precautions should be taken to avoid unnecessary sources of dust emissions or use of aerosol sprays. Sampling requirements (e.g., flow rate, sampling time) may need to be adjusted accordingly to avoid filter overload.

7.0 Quality Assurance/Quality Control

Quality assurance/quality control (QA/QC) for activities described in this SOP will be attained through a variety of processes, including, but not limited to, the items discussed below. Additional QA/QC requirements, such as audits or field assessments, will be addressed in the governing document referencing this SOP.

7.1 Training

Every effort will be made to ensure consistency in collecting air samples in support of the Libby Site. Consistency will be achieved to the extent possible through proper training, using designated field staff, and providing TL oversight. Any deficiencies or inconsistencies in implementing this SOP noted by the TL will require re-training of the field team.

7.2 Equipment Maintenance

The manufacturer's instructions regarding operating procedures and maintenance will be reviewed prior to equipment use. Equipment and instrumentation will be utilized in accordance with manufactures instructions.

7.3 Field Quality Control Samples

The field quality control (QC) samples for air sampling at the Libby Site typically consist of lot blanks and field blanks. Refer to the governing document referencing this SOP for field QC sample collection requirements and acceptance criteria.

8.0 References

U.S. Environmental Protection Agency. 1994. Asbestos Sampling, Standard Operating Procedure #2015, Revision 0.0. November 17.

International Organization for Standardization. 1995. Ambient Air – Determination of Asbestos Fibers – Direct Transfer Transmission Electron Microscopy Method. ISO 10312:1995(E).

Attachment 1

Libby Asbestos Project
Precision Rotameter Calibration Data Sheet

Project Number: _______________

Calibration Date: _______________ Calibrated By: __________________

Odometer ID: __________________ Primary Standard ID: _____________

Actual Temp. (ºF): ______________ Actual Pressure (in. Hg): __________

°F = degrees Fahrenheit
in. Hg = inches mercury

	Ball Reading =Y (mid-ball)	Flow Rate = X_1 (L/min)
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

Rotameter Calibration Procedure:

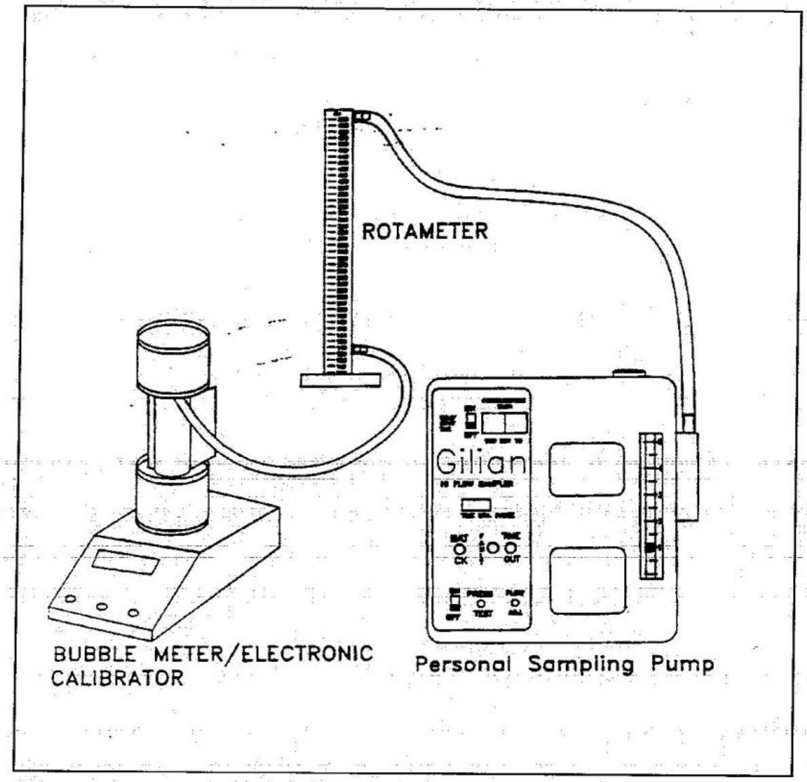
1. Obtain the actual temperature and actual pressure in Libby, MT from the local NOAA weather station. Record the actual temperature and actual pressure in the fields provided above.
2. Calibrate rotameter to desired ball reading with a sampling pump and cassette in-line. The cassette must be the same type and from the same lot of cassettes that will be used for sampling. Record the value in the “Ball Reading” column above.
3. Check the adjusted flow rate of the sample pump to the DryCal® primary flow standard. Ten repetitive flow measurements will be averaged and that result recorded in the “Flow Rate” column for the selected interval.
4. Repeat this process at 10 intervals over the range of the precision rotameter. Input data into rotameter calculation sheet to generate the corrected flow rate.

Attachment 2

APPENDIX B (Cont'd)

Figures

FIGURE 4. Calibrating a Rotameter with a Bubble Meter



16

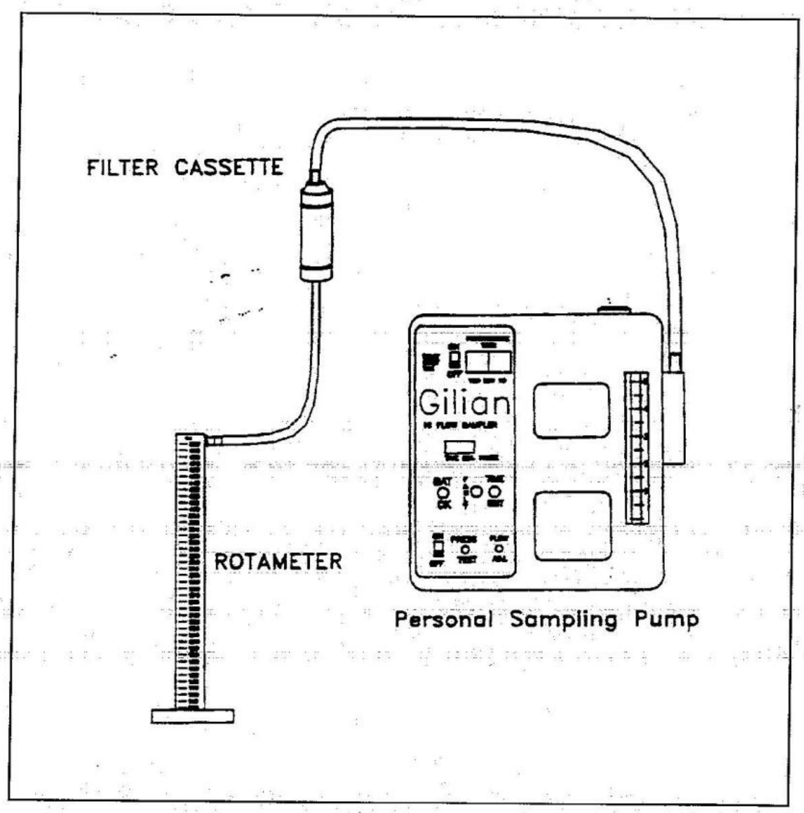
Figure obtained from EPA SOP #2015 (EPA 1994).

Attachment 3

APPENDIX B (Cont'd)

Figures

FIGURE 5. Calibrating a Sampling Pump with a Rotameter



17

Figure obtained from EPA SOP #2015 (EPA 1994).

Site-Specific Sampling Guidance
Libby Superfund Site

SOP No.: CDM-LIBBY-06, Revision 1

SOP Title: Semi-Quantitative Visual Estimation of Vermiculite in Soils at Residential and Commercial Properties

Approved by:

______________________________ 5/10/07
Technical Reviewer Date

______________________________ 5/10/07
QA Reviewer Date

______________________________ 05/10/07
Volpe Center Approval Date

______________________________ 5/10/07
EPA Approval Date

Section 1
Purpose

EPA will identify and delineate the extent of any visible vermiculite (VV) present in soils as part of all investigations conducted at the Libby Superfund Site and specified in governing guidance documents. The goal of this standard operating procedure (SOP) is to provide a consistent approach to identify and characterize any VV present in soils.

The semi-quantitative approach presented in this SOP for visually estimating VV in soil will be revised as required to optimize data collection as the sampling teams gain experience. This will be accomplished by expanding and/or improving this SOP, supporting pictorial standards, and additional electronic data acquisition efforts, as necessary.

Section 2
Definitions

Specific Use Area (SUA) – Discrete exterior parcels on a property with a designated specific use. Due to the nature of activities typically carried out in SUAs, residents may be especially vulnerable to exposures when Libby amphibole asbestos (LA) contaminated soil becomes airborne. SUAs may be bare or covered with varying amounts of vegetation. SUAs include:

- Flower Pot
- Flowerbed
- Garden
- Stockpile
- Play Area
- Dog Pen
- Driveway (non-paved)
- Parking Lot (non-paved)
- Road (non-paved)
- Alley (non-paved)

Common Use Area (CUA) – Exterior parcels on a property with varied or generic use. CUAs may be bare or covered with varying amounts of vegetation. CUAs include:

- Walkway
- Yard (front, back, side, etc.)
- Former Garden
- Former Flowerbed

Limited Use Area (LUA) – Exterior parcels on a property that are accessed, utilized, and maintained on a very limited basis. LUAs may be bare or covered with varying amounts of vegetation. LUAs include:

- Pasture
- Maintained/Mowed Fields
- Underneath porches/decks[1]
- Overgrown Areas (with trails/footpaths, or between SUAs/CUAs)

Interior Surface Area (ISA) – Interior soil surfaces of buildings such as garages, pumphouses, sheds, and crawlspaces.

Non-Use Area (NUA) – Exterior parcels on a property with no current use (e.g., areas that are un-maintained and not accessed). NUAs may be bare or covered with varying amounts of vegetation. NUAs include:

- Wooded Lots
- Un-maintained Fields

Since NUAs are not currently accessed, they are not presently considered a complete exposure pathway. As such, semi-quantitative visual estimates of vermiculite in soil will not be captured at this time. However, to the extent that NUAs may become a complete exposure pathway in the future, EPA may revisit these NUAs at a later date.

Zone[2] – Parcels on a property that share a similar land use or subdivisions of a land use area based on site conditions (e.g., access, construction setup considerations, etc.) or sampling requirements. No area type may be combined with any other area type. For example, driveways and flowerbeds are both SUAs but will be separated into unique zones for visual inspection. Similarly, large CUAs such as yards may be subdivided into front yard, side yard, and back yard zones dependent on site conditions. Sectioning properties into additional zones will be at the discretion of the field team leader but consistent among the teams.

It is anticipated that SUAs and ISA zones will generally tend to be smaller parcels. Combining small, proximal SUAs into one zone will be at the discretion of the field team leader but consistent among teams. No ISA will be combined with any other ISA for visual inspection. There is not a maximum square footage restriction on any zone.

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[1] The soils underneath porches and decks will be classified as LUAs depending on ground clearance and accessibility to homeowners and pets. If these areas are not accessible, they will be classified as NUAs.

[2] The restriction on the maximum square footage of SUA zones (1,000 ft2) and non-SUA zones (2, 500 ft2) was eliminated from the previous iteration of this SOP after the data were reviewed by EPA and determined to sufficiently characterize the presence of VV regardless of zone square footage. Additionally, this will allow the flexibility necessary for field teams to identify areas of zones most cost effectively for removal purposes.

Point Inspection (PI) – Used in SUA, CUA, LUA, and ISA zones. A PI is an intrusive visual inspection of the top portions of the soil at a randomly selected point within a zone. A PI consists of the active displacement of the surface soil with a small shovel and visual inspection of the displaced soil to determine if VV is present. If VV is observed during the PI, the location and a semi-quantitative estimate of VV contamination will be recorded.

Section 3
Applicability

This SOP applies to properties within the Libby Superfund Site at varying stages of the removal process including, but not limited to, all screening and risk-based investigations, pre-design inspections, and removal actions. Investigation-specific modifications to this SOP are outlined in the governing guidance document for each investigation. The following locations on a property will be evaluated for the presence/absence of VV:

- All parcels on a property where soil samples are being collected.
- All parcels on a property where soil was non-detect for LA during previous sampling activities.
- All SUA parcels on a property that have not been previously characterized as containing VV

Section 4
Procedure

Figure 1 illustrates the procedures and decision rules for this SOP. The three primary procedural steps are listed below:

- Establish zones
- Perform PI
- Perform semi-quantification of visual vermiculite

Each is described in the following subsections.

4.1 Establish Zones

Upon arrival at the property, the field team will locate all areas requiring sample collection (i.e., where previous soil sample results were non-detect for LA or SUAs have not been previously characterized for VV). Parcels will be identified as SUA zones, CUA zones, LUA zones, NUA zones, or ISA zones. The field team will measure the zone sizes and note them on the field sketch and/or design drawings. Zones will be assigned according to the definitions provided above.

4.2 Point Inspections[3]

As defined above, a PI is an intrusive visual inspection performed for the entire surface of a zone. Professional judgment may be used to determine the exact location of PIs; however, the following guidelines will be implemented to maintain consistency.

A minimum of 30 PIs will be evaluated per zone if sampling is required within that zone. If soil sampling is not required, a minimum of 5 PIs will be evaluated within each zone. Zones larger than 500 square feet (ft^2) will require evaluation at a minimum of 1 PI per 100 ft^2 (10 ft by 10 ft area). The PI locations will be randomly selected and will be spatially representative of the entire zone. Locations of the PIs and semi-quantitative estimates of VV (i.e., low, intermediate, or high) will be recorded on the field sketch for each PI. While a minimum of 5 PIs will be conducted per zone, there is no set maximum. Rather, the maximum number of PIs is variable—dependent upon the total area of the zone and achieving the minimum required frequency of 1 PI per 100 ft^2.

The following sections outline procedures for inspecting each use area (e.g., SUA, CUA, LUA, ISA). The procedure for semi-quantification of VV is provided in the next section.

<u>SUA Zone:</u>

- Visually inspect the PI point using a spade or trowel to remove any cover material, including excess debris (e.g., mulch, rock, etc.) and organic material, from the surface of the soil. Remove and visually inspect soil to a depth of 0-6 inches below ground surface[4].
- If a depth of 6 in. cannot be attained given the varying levels of compaction in driveways, roads, etc. the maximum depth attainable will be documented in the field logbook.
- Record semi-quantitative estimate of VV observed as described in the following section.
- Replace soil and cover material.
- Repeat as necessary employing procedure outlined above.

<u>CUA and LUA Zones:</u>

- Visually inspect the PI point using a spade or trowel, carefully removing organic material, including grass, from the surface of the soil. Remove and visually inspect soil to a depth of 0 - 3 inches below ground surface[5].

[3] Surface Inspections- The non-intrusive visual inspection of the immediate surface of a zone was eliminated from the previous iteration of this SOP after their data were reviewed and determined by EPA to provide no additional information over that gained through Point Inspections.
[4] A soil depth of 6 inches for SUAs was chosen to approximate the depths to which digging would be expected during typical activities occurring in these SUA zones (e.g., gardening, child digging in dirt, etc.)
[5] A soil depth of 0-3 inches was chosen to approximate the depths to which soil disturbance would be most likely during typical activities occurring in these CUA and LUA zones (e.g., lawn mowing, etc.)

- Record semi-quantitative estimate of VV observed as described in the following section.
- Carefully replace all soil and organic material.
- Repeat as necessary employing procedure outlined above.

<u>ISA Zone:</u>

- Move items as necessary to access the soil surface.
- Visually inspect the PI points using a spade or trowel, remove and visually inspect soil to a depth of 0 - 3 inches below ground surface[6].
- Record semi-quantitative estimate of VV observed as described in the following section.
- Repeat as necessary employing procedure outlined above.

If during the PI, VV is observed to be localized within a zone, the portion with vermiculite will be denoted on the field sketch. If additional PIs are necessary to determine the boundaries of the area, approximately 10 to 20% additional PIs will be evaluated to determine the extent of localized vermiculite.

4.3 Semi-Quantification of Visual Vermiculite

During PI, the field team will estimate the quantity of vermiculite observed. Each PI location for all zones will be assigned a semi-quantitative estimate of visible vermiculite content using a 4-point scale: none (blank), low (L), intermediate (M), and high (H)[7]. For PI locations where VV is observed, semi-quantitative estimates (e.g., L, M, or H) will be recorded on the field sketch. PI locations where VV is not observed will not be recorded on the field sketch. Photographs illustrating these quantities are attached to this SOP as Figure 2. Additionally, jars of vermiculite-containing soils representing these three levels will be available for training and reference.

Under the current version of this SOP, there will be no effort to design an approach to combine vermiculite levels for PIs within or among zones. While the viability of combining semi-quantitative visual estimates within or among zones may be assessed as a pilot-scale evaluation, any PI with visible vermiculite qualifies as vermiculite-containing soil for the area represented by the inspection point or inspection zone.

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[6] A soil depth of 0-3 inches was chosen to approximate the depths to which soil disturbance would be most likely during typical activities occurring in these IS zones (e.g., entering crawlspace, retrieving items from shed, etc.)

[7] Based on EPA's review of previous data, the 5-level scale VV identification scheme was not meaningful and will be reduced to a 4-level scale. As such the quantity of "Gross" VV in the previous iteration of this SOP was combined with High. Previously collected data of Gross VV should be considered analogous to High VV under this revised SOP.

Section 5
Health & Safety/Engineering Controls

All personnel will carry out visual inspections in accord with proper personal protective equipment (PPE) and other monitoring/governing requirements outlined in the most recent version of the Site Health and Safety Plan governing the work being conducted.

All visual inspections will employ appropriate engineering controls to minimize dust (e.g., wetting soil during inspection) as prescribed in the Site-Specific Standard Operating Procedure for Soil Sample Collection (CDM-LIBBY-05, Revision 2).

Section 6
Equipment Decontamination

Equipment decontamination is not required between each PI from the same zone, but is required before moving to another inspection zone. Decontamination of equipment will be conducted as required by the governing guidance documents.

Section 7
Documentation

As noted above, information about the presence of vermiculite will be recorded on the field sketch or design drawing for the property under investigation. Each zone will be marked with:

- Zone type (i.e., SUA, CUA, LUA, NUA, or ISA)
- Zone area in ft^2
- PI locations/points
- Semi-quantitative estimate of VV content for each PI (i.e., L, M, H)

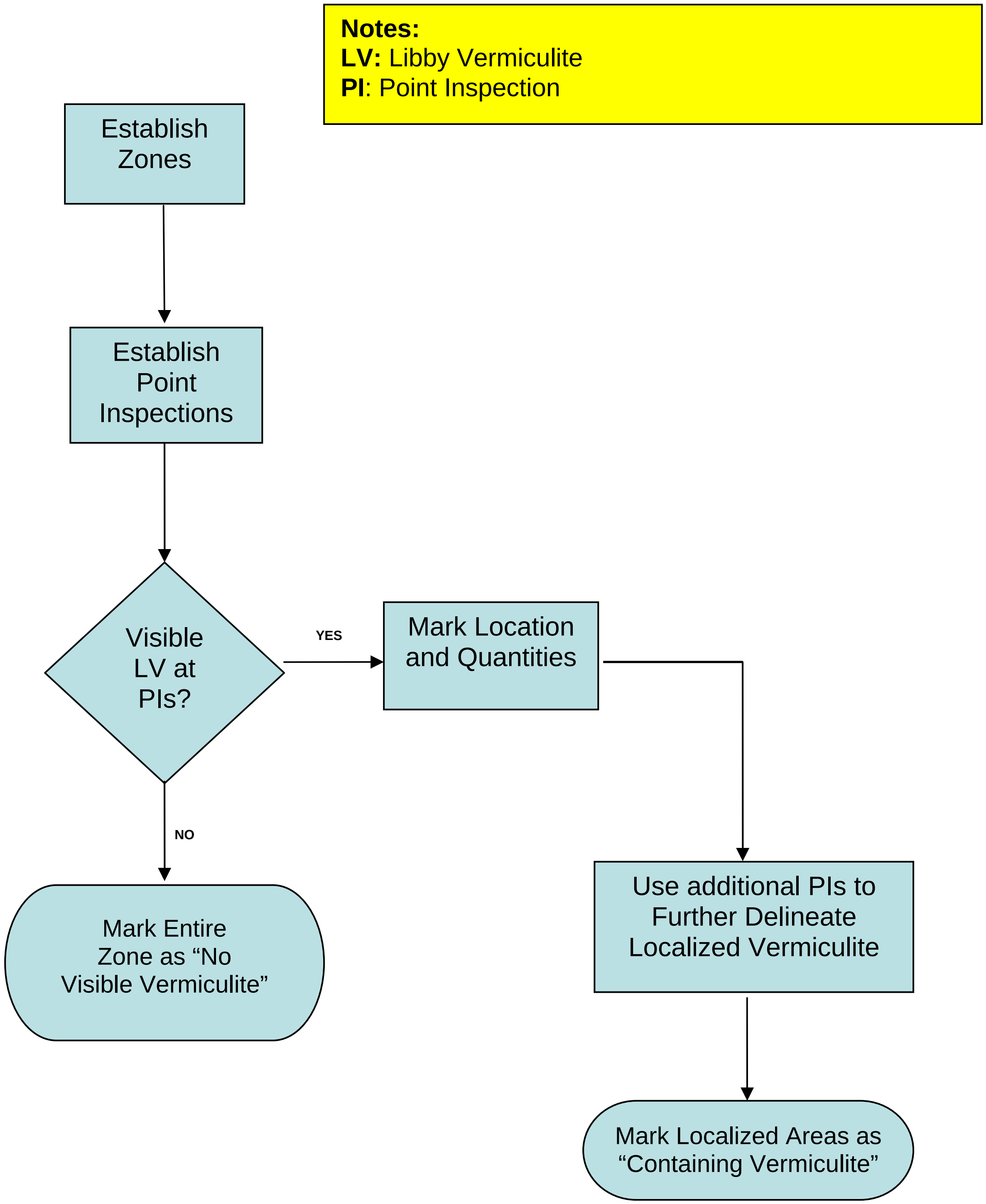
In addition to field sketch/design drawing documentation, each field team will generate a Visual Vermiculite Estimation Form (VVEF) (Figure 3) to document the semi-quantitative visual estimates of VV for each PI for possible future information use. This form will be managed according to governing guidance documents.

Section 8
Training

Every effort will be made to ensure consistency in the semi-quantitative evaluation of VV in soil to the extent possible. This will include training (e.g., field calibration), specimen examples (i.e., jars/photographs of low, intermediate, and high quantities of vermiculite, etc.), designated field staff, and oversight by the field team leader. Figures illustrating none, low, intermediate, and high quantities of vermiculite are attached to this SOP for reference (Figure 2).

To ensure consistency over time, the field team leader will verify semi-quantitative assignments at a rate of one property per team per week. The field team leader will sign off on those field sketches that were verified. If inconsistencies are noted, the field team leader will hold re-training with all teams participating simultaneously. Updates to the SOP and its attached specimen examples will occur as necessary and the EPA Project Team Leader and Technical Assistance Unit will be notified when these updates are recommended by the field team leader or field investigation manager.

Figure 1 – Visible Vermiculite Inspection Process



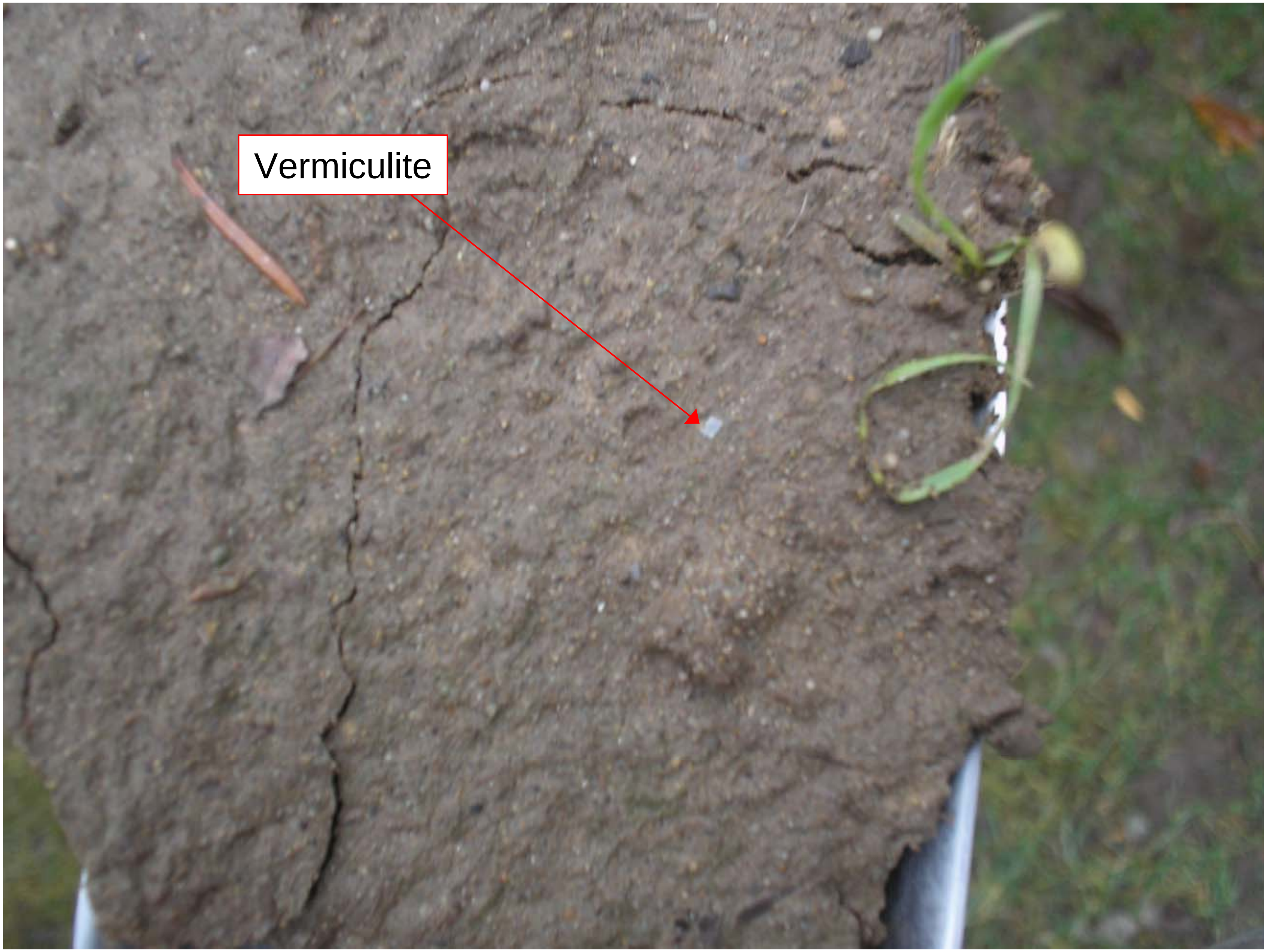


Figure 2a: Low Visible Vermiculite – A maximum of a few flakes of vermiculite observed within a given visual inspection point

Figure 2b: Intermediate Visible Vermiculite – Vermiculite easily observed throughout visual inspection point, including the surface.

Figure 2c: Intermediate Visible Vermiculite – Vermiculite easily observed throughout visual inspection point, including the surface.

Figure 2d: High Visible Vermiculite – Vermiculite easily observed throughout visual inspection point, including the surface.

LIBBY SUPERFUND SITE
Visual Vermiculite Estimation Form (VVEF)

Field Logbook No.: ____________ Page No.: ____________ Site Visit Date: ____________ BD Number: ____________
Address: ____________ Structure Description: Property
Occupant: ____________ Phone No.: ____________
Owner (If different than occupant): ____________ Phone No.: ____________
Investigation Team: ____________ Investigation Name: ____________
Field Form Check Completed by (100% of Forms): ____________ Visual Verification by Field Team Leader (10% of forms): ____________

		Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8
Type (SUA/CUA/LUA/IS)									
Description									
Area Size (square feet)									
General Comment (Cover, etc.)									
PIs (X=None, L=Low, M=Intermediate, H=High)	**X**								
	L								
	M								
	H								
	Total	0	0	0	0	0	0	0	0

Areas previously identified for removal not inspected for visible vermiculite? **Yes** **No** **NA** **Location(s):** ____________

____

____

Date: September 4, 2012 SOP No. EPA-LIBBY-09 (Revision 2)

Title: STANDARD OPERATING PROCEDURE FOR TEM DATA REVIEW AND DATA ENTRY VERIFICATION

Author: Erin Formanek (CDM Smith)

SYNOPSIS: This standard operating procedure (SOP) provides a standardized method for review of raw transmission electron microscopy (TEM) data and verification of entry of TEM results into the project database. Steps included in this SOP are: a) selection of TEM analyses for review and verification, b) review of the original laboratory TEM benchsheets, and c) verification of the transfer of results from the benchsheets into the project database. This method is applicable for use only at the Libby Asbestos Superfund Site.

APPROVALS:

TEAM MEMBER	SIGNATURE/TITLE	DATE
EPA, Region 8	Dania Zinner, RPM	9/4/12
CDM Smith	Erin Formanek	9/4/12

Revision	Date	Summary of Changes
0	12/7/06	--
1	3/5/08	▪ Modify selection procedure to exclude: 1) records associated with files uploaded due to error corrections, and 2) samples that will be validated under other review efforts. ▪ Modify SOP to include a check of samples with errors to ensure that corrections were made properly. ▪ Change review time period from monthly to quarterly. ▪ Add consistency review of data entered in accord with LB-000066. ▪ Refer to LB-000016 (ISO) and LB-000031 (AHERA/ASTM) for appropriate aspect ratio recording rules.
2	9/4/12	▪ Added detail for the various roles of personnel involved in the verification process. ▪ Added diagram for workflow (Figure 1). ▪ Removed reference to the Libby2 Database. ▪ Added additional fields to be verified in the project database. ▪ Updated the names of the laboratory modifications that are referenced for appropriate aspect ratio recording rules. ▪ Remove previously specified required verification frequency because some verification is expected to happen during the quarterly validation process.

1.0 OBJECTIVE

The purpose of this standard operating procedure (SOP) is to provide a standardized method for consistency review of transmission electron microscopy (TEM) data and analytical method(s) in the project database, and verification of results entered in the project database, and the electronic data deliverables (EDDs). **Figure 1** presents a flow diagram of the TEM verification process. Information included in this SOP is organized into the following sections:

2.0 Personnel and Qualifications
3.0 Data Summary Tables
4.0 Selection of TEM Records for Review
5.0 Consistency Review Procedure for TEM ISO 10312
6.0 Consistency Review Procedure for TEM AHERA/ASTM
7.0 Verification of Data Transfer from the Benchsheet to the Project Database
8.0 Reporting
9.0 References

2.0 PERSONNEL AND QUALIFICATIONS

Verification Data Manager

The verification data manager should be proficient in Microsoft® Access and Microsoft® Excel, as well as be familiar with TEM analytical reporting. The verification data manager is responsible for creating the Data Summary Tables (see **Attachment 1**) by querying the project database. The verification data manager is also responsible for coordinating with the database manager to ensure that discrepancies discovered in the data verification process have been resolved properly.

Database Manager

The database manager is responsible for maintaining the project database/laboratory documentation and coordinating with the laboratories to communicate discrepancies discovered during the verification process.

Data Verifier

The data verifier must be skilled and/or trained in interpretation of raw laboratory benchsheets and electronic data reporting files in support of TEM analysis. Data verifiers must be well-versed in TEM counting and recording rules as specified in TEM ISO 10312:1995(E) (ISO 1995), TEM AHERA (AHERA 1986), and ASTM D 5755-09 (ASTM 2009).

Data verifiers must also be well-versed in project-specific counting and recording rules as presented in the governing project documents that specify sampling and analysis procedures (e.g., Site Management Plan [SMP], Sampling and Analysis Plan [SAP], Quality Assurance Project Plan [QAPP]) to perform the required consistency reviews.

Data Verification Coordinator

The data verification coordinator (DVC) must be skilled in interpretation of raw laboratory benchsheets and electronic data reporting files in support of TEM analysis. DVCs must be well-versed in TEM counting and recording rules, as well as any project-specific counting and recording rules, as presented in the governing project documents that specify sampling and analysis procedures (e.g., SMP, SAP, QAPP). Lastly, DVCs are responsible for the following:

--Ensuring that verification reports are clear and accurate
--Ensuring that the steps outlined in this SOP are followed
--Training of data verifiers

3.0 DATA SUMMARY TABLES

Data Summary Tables are to be created by the verification data manager in Microsoft® Excel format and provided to the data verifier. Data Summary Tables will be used by the data verifier to select the TEM analyses for verification and to compare the project database results to the hand-written laboratory benchsheets. **Attachment 1** presents an example of the Data Summary Tables for TEM. **Attachment 1A** illustrates the analytical and result information that will be verified. **Attachment 1B** illustrates the raw structure information that will also be verified.

4.0 SELECTION OF TEM RECORDS FOR REVIEW

The fraction of TEM records selected for review and verification will depend upon project-specific data quality needs. If less than 100% of analyses are to be verified, the goals for selecting a representative subset of TEM results for review and verification are provided below.

Over the course of a project, a minimum of ten percent (10%) of all field samples for which TEM analyses have been performed will be reviewed and verified. Laboratory quality control (QC) analyses, such as recounts and repreparations, will be excluded from the verification process (as their review is conducted as part of data validation). Selections should be made to ensure representation across the laboratory analysts performing TEM analyses. All TEM analyses will be stratified by analyst, with the number of analyses from each analyst selected for verification being in proportion to the total number analyzed. In addition, analyses will be stratified according to detect/non-detect status, with approximately 50% of the analyses selected for verification being detects, and 50% being non-detects. The following table illustrates the selection process if the goal is to select 10% of TEM analyses for review:

	Number TEM Analyses Completed			Number TEM Analyses Selected		
Analyst	Detect	Non-Detect	Total	Detect	Non-Detect	Total
1	14	112	126	11	6	17
2	20	421	441	16	22	38
3	2	4	6	2	1	3
4	0	8	8	0	1	1
Total	36	545	581	29	30	59

	Number to be Selected Based on 10% Goal	Actual Number Selected
Total	58	59
Detect	29	29
Non-Detect	29	30

In this example, there are a total of 581 analyses available (36 detects + 545 non-detects), analyzed by four different analysts. Thus, the total number of analyses to be selected for review is 10% x 581 = 58.1 (rounded to 58). This total is to be split evenly between detects (29) and non-detects (29). The number of detects and non-detects selected for each analyst is calculated by multiplying the target number (29) by the fraction of the total detects and non-detects evaluated by the analyst. For example, for Analyst 1:

Number of detects selected = 29 x (14/36) = 11.3 (rounded to 11)
Number of non-detects selected = 29 **x** (112/545) = 5.9 (rounded to 6)

If an analyst has analyzed at least one analysis in a category (detect or non-detect), the minimum number of analyses to be selected is one. For example, for Analyst 4, the number of detects analyzed is zero, so the number of detects selected is zero. For Analyst 4, the number of non-detects to be selected (computed using the approach above) is:

Number of non-detects selected = 29 **x** (8/545) = 0.4

In this case, the number selected for verification is set to the minimum of 1.

As seen, this procedure will tend to select a higher proportion of detects (29 of 36 analyses, 81%) than non-detects (30 of 545 analyses, 6%). This approach is used because it is considered likely that the incidence of errors will be higher in analyses with one or more detected structures than in analyses with no detected structures.

The analyses that have been selected for analytical result verification should also undergo a verification of the field sample data sheet (FSDS) information. This verification process is outlined in Libby-specific SOP EPA-LIBBY-11.

5.0 CONSISTENCY REVIEW PROCEDURE FOR TEM ISO 10312

For each TEM ISO 10312 analysis to be verified, the data verifier will locate the original hand-written laboratory documentation within the appropriate laboratory job[a]. This hand-written documentation includes the laboratory benchsheets, internal laboratory chain of custody, and filter preparation logs. The data verifier will either print hard copies (if laboratory job provided as a PDF) or make photocopies (if laboratory job is provided as a hard copy data package) of the associated laboratory documentation for each TEM analysis selected for verification so that a hard copy is available for use in the verification.

Figure 2 presents an example laboratory benchsheet. The data verifier will review the original hand-written laboratory benchsheets to determine if the raw structure data were recorded by the analyst in accordance with TEM ISO 10312 counting rules and any project-specific recording rules. The types of information to be reviewed include:

--The recorded structure types are consistent with the TEM ISO 10312 counting rules. Valid structure types include F, B, CC, CD, CF, CFO, CB, CBO, CR, MC, MD, MF, MFO, MB, MBO, and MR.

--Disperse complex structures (i.e., CD, MD) are broken down in accordance with TEM ISO 10312 counting rules and compact complex structures (i.e., CC, MC) are not broken down. For example, a CD43 should provide 4 secondary structures, with three secondary structures having a length greater than 5 um. In this example, the structure

[a] The laboratory job is either a hard copy data package or a scanned copy of the hard copy data package provided as a portable document file (PDF) by the analytical laboratory.

type for each of the recorded secondary structures should begin with the "C" prefix (e.g., CF, CB, CR).

--The primary and total columns on the laboratory benchsheet have been populated with non-zero numbers for all countable structures and a zero for all non-countable structures. If the primary and total columns have not been populated at all, it can be assumed that all structures recorded are countable unless otherwise stated in the comment field.

--If recorded, all non-asbestos mineral (NAM) structures are identified as non-countable structures.

--All recorded fibers (i.e., F, CF, MF) meet the appropriate aspect ratio requirement. [See the governing project documents for aspect ratio recording rules for ISO 10312.]

-- If Libby Laboratory Modification LB-000066 is applicable (as indicated in the project governing documents), the mineral type (e.g., WRTA) and appropriate spectra code (e.g., NaK) is recorded in the appropriate fields for all recorded LA, OA, and NAM structures.

--The mineral class is populated for all structures.

--Structure comments (e.g., < 3:1) are supported by recorded data.

6.0 CONSISTENCY REVIEW PROCEDURE FOR TEM AHERA/ASTM

For each TEM AHERA/ASTM analysis to be verified, the data verifier will locate the original hand-written laboratory documentation within the appropriate laboratory job[b]. This hand-written documentation includes the laboratory benchsheets, internal laboratory chain of custody, and filter preparation logs. The data verifier will either print hard copies (if laboratory job provided as a PDF) or make photocopies (if laboratory job is provided as a hard copy data package) of the associated laboratory documentation for each TEM analysis selected for verification so that a hard copy is available for use in the verification.

Figure 2 presents an example laboratory benchsheet. The data verifier will review the original hand-written laboratory benchsheets to determine if the raw structure data were recorded by the analyst in accordance with AHERA/ASTM counting rules and any project-specific recording rules. The types of information to be reviewed include:

--The recorded structure types are consistent with the counting rules. For AHERA/ASTM, valid structure types include F, B, M, and C.

--The total column has been populated with non-zero numbers for all countable structures and a zero for all non-countable structures.

[b] The laboratory job is either a hard copy data package or a scanned copy of the hard copy data package provided as a portable document file (PDF) by the analytical laboratory.

--If recorded, all non-asbestos mineral (NAM) structures are identified as non-countable structures.

--The recorded structures meet the counting rule requirements. For AHERA/ASTM, all recorded fibers and matrices meet the appropriate aspect ratio requirement. [See the governing project documents for aspect ratio recording rules for AHERA/ASTM.]

--The recorded dimensions for matrices are the protrusion dimensions, not the matrix dimensions (provided sketches will be used to qualitatively assess dimensions).

--The mineral class is populated for all structures.

--If Libby Laboratory Modification LB-000066 is applicable (as indicated in the project governing documents), the mineral type (e.g., WRTA) and appropriate spectra code (e.g., NaK) is recorded in the structure comment field for all recorded LA, OA, and NAM structures.

--Structure comments (e.g., < 5:1) are supported by recorded data.

7.0 VERIFICATION OF DATA TRANSFER FROM THE BENCHSHEET TO THE PROJECT DATABASE

The following steps will be performed by the data verifier to ensure that data entered into the project database were entered properly. This data transfer verification can be accomplished by comparing the data in the project database (i.e., the data provided in the Data Summary Tables) to the handwritten benchsheets. If a discrepancy is noted, the verifier should confirm where in the data flow process that the error occurred. This can be achieved by reviewing the EDD that was submitted by the laboratory to confirm whether or not the data entry occurred successfully. If there is an error in the data entry to the EDD, correction to the EDD is needed. Otherwise, it is likely that the data upload procedure resulted in a misrepresentation of the data. In this case, the database manager will need to revise the upload procedure and reload the EDD.

7.1 The data verifier will verify the analysis-specific information provided in the Data Summary Tables (see **Attachment 1A**) against the original laboratory job documentation (i.e., laboratory benchsheets, internal laboratory chain of custody, filter preparation logs). [Note: Whenever possible, verification should be performed against hand-written notations, NOT internal laboratory summary tables prepared from hand-written notes. If hand-written notes are not available, this should be noted in the written report summarizing findings and recommendations that will be created at the end of the data verification process.]
Some examples of analysis-specific information that will be verified are provided below:

--Analysis Method
--Analysis Date
--Analyst Name
--Laboratory Name
--Laboratory Job Number
--Laboratory Sample Number
--Preparation Type (Direct, Indirect, or Indirect with Ashing)

--Effective Filter Area (EFA, mm^2) *[If direct preparation, value should match the primary filter area. If indirect preparation, value should match secondary filter area.]*
--Grid Opening Area (Ago, mm^2)
--Sample Type
--Sample Quantity [*For air samples, if the air volume on the benchsheet is within 2 liters of the volume on the Data Summary Table, rank this as concordant. Note: it is assumed that the air volume reported on the chain of custody is accurate. Verification of the air volume reported on the chain of custody is performed as part of the FSDS data verification and is outside the scope of this SOP.]*
--Sample Quantity Units
--Analysis Comments[c]
--Stopping and recording rules

Note that the fields presented in Attachment 1A are those that need to be verified for air and dust samples. There are additional fields that will need to be verified for other media types (as appropriate) as summarized below:

--Sample mass
--Sample mass units
--Ash residue total
--Ash residue total units
--Ash residue aliquot
--Ash residue aliquot units
-- FBA flow ratio
--Sample diameter
--Sample diameter units
-- Structures >10 um for LA, OA, and CH

7.2 The data verifier will check the calculation of the F-factor based on hand-written entries on the original hand-written laboratory benchsheet or filter preparation logs as shown in **Table 1.** The calculated F-factor will be compared with the column titled "F-factor" in the Data Summary Table (see **Attachment 1A**).

7.3 Using the original hand-written laboratory benchsheets, the data verifier will count the total number of unique grid openings evaluated. The number of grid openings counted will be compared with the grid openings counted in the Data Summary Table, which are grouped by mineral class and magnification level (see **Attachment 1A**). [Note: If the total number counted by the data verifier does not match the value in the grid openings counted column, this is an indicator that a grid opening was skipped, duplicated, or that a grid opening name was incorrectly entered into the EDD during the laboratory data entry process.]

7.4 Using the original hand-written laboratory benchsheets, the data verifier will count the number of asbestos structures for each mineral class across the grid openings evaluated. This

[c] The analysis comments field is to be reviewed for any applicable information regarding analysis status not captured in the "Filter Status" field which may impact the integrity of the sample results (e.g., Overloaded, Damaged, Missing, Canceled).

number will be compared with the columns titled “STRUCTCONCHIGHMAG” and/or “STRUCTCONCPCME” in the Data Summary Table for the corresponding mineral class (see **Attachment 1A**). Structure count results should be compared to both the “HighMag Structures” and “PCME Structure” columns if the analysis was performed at high magnification (i.e., ~20,000x). Structure count results should be compared only to the “PCME Structure” columns if the analysis was performed at low magnification (i.e., ~5,000x).

If asbestos structures recorded are part of a complex primary structure, only the secondary structures should be counted. For example, for a disperse matrix that consists of a primary matrix particle with 2 component fibers longer than 5 um (MD22), count the two component matrix fibers (MF), but not the primary matrix.

7.5 Using the original hand-written laboratory benchsheets, the data verifier will check the transfer of the raw structure data from the laboratory benchsheet to the Data Summary Table containing the raw structure results (see **Attachment 1B**). The data verifier will check the following fields:

--Grid
--Grid opening name
--Structure type
--Primary structure number
--Total structure number
--Structure type
--Structure dimension (length and width) *[In the event that the structure dimensions are recorded on the laboratory benchsheet as screen units, the recorded structure dimensions should be multiplied by the appropriate length and width screen units provided on the laboratory benchsheet to verify the dimensions present on the Data Summary Table.]*
--Mineral class
--Mineral description
--EDXA observation
--Structure identification
--Chrysotile count (this field records whether chrysotile structures, if observed, would have been recorded for the grid opening)
--Low Mag (this field records if the grid opening was examined under low magnification)
--Structure comments

7.6 The data verifier will ensure that an appropriate stopping rule has been met. As noted above, the governing project documents (e.g., SMP, SAP, QAPP) should specify the applicable TEM stopping rules. The data verifier should check that at least one stopping rule has been met and enter which rule(s) were met in the “Stopping Rule Achieved” column in the Data Summary Table.

7.7 The data verifier will check the calculation of the analysis sensitivity:

Air sensitivity $(cc)^{-1}$ = EFA / [GOx * Ago * F-factor * Air Volume (L)* 1000]
Dust sensitivity $(cm^2)^{-1}$ = EFA / [GOx * Ago * F-factor * Dust Sample Area (cm^2)]
Water sensitivity $(L)^{-1}$ = EFA / [GOx * Ago * Volume applied to the filter (L)]

Tree bark sensitivity $(cm^2)^{-1}$ = EFA / [GOx * Ago * F-factor * Bark Surface Area (cm^2)]
Duff/Tissue sensitivity $(g)^{-1}$ = EFA / [GOx * Ago * F-factor * Pre-Ashing Sample Mass (g)]
Fluidized bed soil sensitivity $(g)^{-1}$ = EFA / [GOx * Ago * F-factor * Sample Mass (g) * Q_R]

where:

EFA = effective filter area, in square millimeters (mm^2)
GOx = grid openings counted
Ago = grid opening area (mm^2)
Q_R = fluidized bed flow ratio
L = liters
g = grams
cm^2 = square centimeters
mm^2 = square millimeters

7.8 The data verifier will check the calculation of the sample concentration:

Concentration = Number of Asbestos Structures * Sensitivity

8.0 REPORTING

For each field to be verified, if the data in the Data Summary Table matches the information in the hard copy laboratory job documentation, mark the appropriate field on the hard copy with a check mark. If the Data Summary Table does not match the hard copy laboratory job documentation, circle the incorrect entry on the hard copy, and note the specific discrepancy in the Data Summary Table in the "Comment" column (see **Attachment 1**). For example, "Grid openings counted is 40 based on hard copy, but 39 in the EDD/database".

As the verification of each selected analysis is completed, the data verifier will enter their company name and their first initial and last name (e.g., E. Smith) in the Data Summary Table in the appropriate columns.

When the verification is complete for all analyses selected, the data verifier will prepare an electronic data verification package. This package will consist of:

-- A summary report summarizing findings and recommendations. **Attachment 2** provides an example template for reporting TEM data verification results.

--A scanned copy of the hard copy laboratory documentation used in the verification process (which includes all verification check marks for reviewed fields).

--An electronic attachment of the Data Summary Tables (which includes any data verifier comments).

The DVC will review the data verification package for accuracy and completeness. If any deficiencies are noted, the DVC will re-train verification personnel and make any corrections as necessary.

In addition to verifying all issues noted in summary report, the DVC will perform an independent data verification of 5% of the analyses verified to ensure that any potential issues have been identified correctly. The DVC will indicate in **Attachment 1** which analyses were selected for review. If any deficiencies are noted, the DVC will re-train verification personnel and make any corrections as necessary. If the DVC disagrees with the error noted in the Data Summary Table, the discrepancy will be revised, and the DVC will replace the verifiers name with his/her name for the analysis. The summary report will be revised by the DVC to reflect any changes as needed.

The electronic data verification package will then be provided to the appropriate project database manager, or their designee, to facilitate the correction process for laboratory EDDs and/or the hand-written laboratory benchsheets by the analytical laboratory. The verification data manager, or their designee, will record the resolution date of any corrections in the appropriate column of the Data Summary Table. Note that all of the following criteria must have been met for a TEM analysis to be considered verified:

--All necessary corrections have been made to the laboratory EDD.
--The corrected laboratory EDD has been re-submitted by the analytical laboratory to the appropriate parties (as specified in the governing project documents).
--The corrected laboratory EDD has been uploaded to the project database.
-- All necessary corrections have been made to the hand-written laboratory benchsheet.
--The corrected hand-written laboratory benchsheet has been re-submitted by the analytical laboratory to the appropriate parties.
--Signatures for the data verifier, DVC, and verification data manager have been added to the verification summary report.

9.0 REFERENCES

Asbestos Hazardous Emergency Response Act (AHERA). 1986. Title 20, Chapter 52, Sec. 4011. Public Law 99-519.

American Society for Testing and Materials (ASTM). 2009. *Standard Test Method for Microvacuum Sampling and Indirect Analysis of Dust by Transmission Electron Microscopy for Asbestos Structure Number Concentrations.* ASTM D 5755-09. American Society for Testing and Materials. January 2009.

ISO. 1995. *Ambient Air – Determination of asbestos fibres – Direct-transfer transmission electron microscopy method.* International Organization for Standardization, Reference Number ISO 10312:1995(E). http://www.iso.org/iso/catalogue_detail.htm?csnumber=18358

FIGURE 1

TEM VERIFICATION PROCESS

FIGURE 1. TEM VERIFICATION PROCESS

Personnel	Step
Verification Data Manager	1. Create Data Summary Tables in Excel and provide to the verifier.
Verifier	2. Select TEM analyses for review.
	3. Locate hand-written laboratory documentation (laboratory benchsheets, COCs, preparation logs) and print or photocopy hard copies for selected
	4. Perform a consistency review utilizing the Data Summary Tables and hand-written laboratory
	5. Verify that analysis-specific data were correctly transferred from the laboratory documentation to the project database (utilizing the Data Summary Tables and hand-written laboratory
	6. Verify the F-factor, GOx, number of asbestos structures reported, analysis sensitivity, and reported concentration in the Data Summary Tables (utilizing the hand-written laboratory
	7. Verify that an appropriate stopping rule was met; record the stopping rule met in the Data
	8. Verify that raw structure data were correctly transferred from the laboratory benchsheet to the database (utilizing the Data Summary Tables and hardcopy hand-written laboratory benchsheets).
	9. Create electronic data verification package and provide to Data Verification Coordinator.
Data Verification Coordinator (DVC)	10. Review electronic data verification package
	11. Provide electronic data verification package to database manager.
Database Manager	12. Correspond with laboratories to ensure appropriate corrections are made to laboratory EDDs/ benchsheets.
	13. Upload corrected laboratory EDDs to project database.
	14. Update project file with revised laboratory
Verification Data Manager	15. Record issue resolution date in the Data Summary Table.
Verifier, DVC, and Verification Data Manager	16. Sign and date verification summary report.

TEM = transmission electron microscopy
COC = chain of custody
EDD = electronic data deliverable
GOx = number of grid openings counted

FIGURE 2

EXAMPLE OF TEM LABORATORY BENCHSHEET

FIGURE 2. EXAMPLE TEM LABORATORY BENCHSHEET

LIBBY
TEM Asbestos Structure Count_Air-DustEDD_37b

Laboratory ID:	
Instrument ID	
Voltage (KV)	
Mag.	HIGH / LOW
Grid opening area (mm2)	
Scale: 1L =	
Scale: 1D =	
Primary filter area (mm2)	
Secondary Filter Area (mm2)	
Category (Field, Blank)	
Primary filter pore size (um)	

EPA Sample Number:		Tag:	
Matrix (A=Air, D=Dust, DF = Dustfall):			
Air volume (L), dust area (cm2), or dustfall container area (cm2)			
Date received by lab			
Lab Job Number:			
Lab Sample Number:			
Number of grids prepared			
Prepared by			
Preparation date			
EPA COC Number:			
Secondary filter pore size (um)			

Analyzed by:	
Analysis date	
Method (D=Direct, I=Indirect, IA=Indirect-ashed)	
If sample type = air, is there loose material or debris in the cowl? (Yes, No)	
Analysis Method (TEM-ISO, TEM-AHERA, TEM-ASTM)	
Grid storage location	
Archive filter(s) storage location	
Lab QC Type (Not QC, Recount Same, Recount Different, Re-prep, Verified Analysis, Reconciliation, Lab Blank, Interlab)	
Estimated Particulate Loading (%)	

F-Factor Calculation (Indirect Preps Only):

Enter data in appropriate cells provided to the right----->

Recording Rules:

Minimum Aspect Ratio (circle one):

none ≥ 3:1 ≥ 5:1

Minimum Length (um): ______

Minimum Width (um): ______

Stopping Rules:

Target Sensitivity: ______

Max Area Examined: ______

Target # of Structures: ______

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions		Identification	Mineral Class (see below)				Mineral Desc	EDXA	Sketch/ Comments	1 = yes, blank = no			CH Not Counted
			Primary	Total	Length	Width		LA	OA	CH	NAM				Sketch	Photo	EDS	

F-factor Calculation:

Indirect Prep Inputs

	Fraction of primary filter used for indirect prep or ashing *[For dust and dustfall, enter 1.0]*
	First resuspension volume or rinsate volume (mL)
	Volume applied to secondary filter (mL) or used for serial dilution

Inputs for Serial Dilutions

	Second resuspension volume (mL)
	Volume applied to secondary filter (mL) or used for serial dilution
	Third resuspension volume (mL)
	Volume applied to secondary filter (mL)

Input for Ashing of Secondary Filter

	Fraction of secondary filter used for ashing

LA = Libby-type amphibole OA = Other (non-Libby type) amphibole CH = Chrysotile NAM = Non-asbestos material

If sample was analyzed by more than one analyst or across multiple analysis dates, enter analysis details below.

	Analyst #2	Analyst #3
Analyzed by:		
Analysis date:		
Instrument:		

Grid opening traverse direction (circle one):
H Horizontal
V Vertical

Are prepped grids acceptable for analysis? (circle one) Yes No
If No, explain:
______
______

TABLE 1

F-FACTOR EQUATIONS

TABLE 1. F-FACTOR EQUATIONS

Media	Filter Preparation	F-Factor Equation
Air/Dust	Direct	F-factor = 1
	Indirect	F-factor = Fraction of primary filter used * (Volume applied to secondary filter / Total re-suspension volume)
	Indirect-Ashed	F-factor = Fraction of primary filter used * (Volume applied to filter for ashing / Total re-suspension volume, pre-ashing) * Fraction of filter that was ashed * (Volume applied to secondary filter / Total re-suspension volume, post-ashing)
Water		F-factor = [1 / ((Total volume after first dilution (mL) / Volume used from primary sample (mL)) * (Total volume after second dilution (mL) / Volume used from 1st dilution (mL))]
Tree Bark		F-factor = [(Ashed residue mass (g), aliquot used in dilution / Ashed residue mass (g), total) * (Volume applied to secondary filter (mL) or used for serial dilution / First resuspension volume or rinsate volume (mL)) * (Volume applied to secondary filter (mL) or used for serial dilution / Second resuspension volume (mL)) * (Volume applied to secondary filter (mL) or used for serial dilution / Third resuspension volume (mL))]
Duff/Tissue		F-factor = [(Ashed residue mass (g), aliquot used in dilution / Ashed residue mass (g), total) * (Volume applied to filter (mL) / Resuspension volume (mL)]
Fluidized Bed Soil	Direct	F-factor = 1
	Indirect	F-factor = [Fraction of original filter used * (Volume applied to secondary filter (mL) / Total suspension volume (mL))]

ATTACHMENT 1

EXAMPLE OF DATA SUMMARY TABLES

ATTACHMENT 1A. DATA SUMMARY OF ANALYTICAL AND RESULT INFORMATIOI

																																	Recording Rules						Stopping Rules				Grid Openings Counted				STRUCTCNTHIGHMAG			STRUCTCNTPCME			Sensitivity		STRUCTCONCHIGHMAG			STRUCTCONCPCME							
Samp No	File Revision No	Lab ID	Instrument	Mag High	Mag Low	GO Size	EFA	Tag	Analysis Quantity	Analysis Quantity Units	Receipt Date	Lab Job Number	Lab SampleID	Number Grid Prep	Preparer Name	Prep Date	Analyst Name	Analysis Date	Prep Method	Loose Material	Analysis Method	Est Filter Loading	Indirect Fraction Primary Filter	Aliquot 1	Volume 1	Aliquot 2	Volume 2	Aliquot 3	Volume 3	Indirect Fraction Secondary Filter	F Factor	Analysis Comments	Min AR High	Min AR Low	Min Length High	Min Length Low	Min Width High	Min Width Low	Target Sens	Maximum GOs	Max Area Examined	Target N Strucs	Chrys High	Chrys Low	LA/OA High	LA/OA Low	LA	OA	CH	LA	OA	CH	LA/OA	CH	LA	OA	CH	LA	OA	CH	Stopping Rule Achieved	Verifier's Company	Verifier's Name	Comment	Correction Date

ATTACHMENT 1B. DATA SUMMARY OF STRUCTURE INFORMATION

Samp No	StructureID	Row Index	Grid	Grid Opening	Structure Type	Primary	Total	Length	Width	AR	Mineral Class	Mineral Desc	EDXA Observation	Structure Identification	Chrysotile Count	Low Mag	Structure Comment	Verifier's Company	Verifier's Name	Comment	Correction Date

ATTACHMENT 2

EXAMPLE OF TEM DATA VERIFICATION SUMMARY REPORT

TEM CONSISTENCY REVIEW AND DATA TRANSFER VERIFICATION REPORT

Project/Dataset Description: ____

SUMMARY OF FINDINGS AND DATA QUALITY IMPLICATIONS

____

____

____

____

____

____

____

Recommendations for future review and verification: ______________________________

____

____

____

____

Data Verifier: ____ ***Date:*** __________

Data Verification Coordinator: ________________________ ***Date:*** __________

Verification Data Manager*: __________________________ ***Date:*** __________

****The Verification Data Manager acknowledges that all issues discovered during the verification process have been resolved and that the following criteria have been met:***

--All necessary corrections have been made to the laboratory EDD.
--The corrected laboratory EDD has been re-submitted by the analytical laboratory to the appropriate parties (as specified in the governing project documents).
--The corrected laboratory EDD has uploaded to the project database.
-- All necessary corrections have been made to the hand-written laboratory benchsheet.
--The corrected hand-written laboratory benchsheet has been re-submitted by the analytical laboratory to the appropriate parties.

TEM CONSISTENCY REVIEW AND DATA TRANSFER VERIFICATION REPORT

TEM ISO 10312 SELECTION AND CONSISTENCY REVIEW RESULTS

Analyst, Lab	Number of TEM ISO 10312 Analyses			Number of TEM ISO 10312 Analyses Selected for Review		
	Detect	Non-Detect	Total	Detect	Non-Detect	Total
Analyst #1, Lab Name						
Analyst #2, Lab Name						
…						
Total						

	Goal	Actual
Selected Total	_______	_______
Selected Detects	_______	_______
Selected Non-Detects	_______	_______

Detailed summary of bench sheet consistency review –

Number of analyses reviewed: _______ (_______% of total analyses selected)

If not all analyses could be reviewed, provide a brief explanation for why: ________________________________

____

Number of analyses with recording issues identified: _______ (_______% of total analyses reviewed)

Types of recording issues identified (indicate the number of analyses):

_______ Reported structure types are inconsistent with ISO 10312

_______ Primary and/or total columns are not populated correctly

_______ NAM structures are recorded and not identified as non-countable

_______ Fibers recorded as countable do not meet counting rules

_______ Mineral class designation is missing or inconsistent

_______ Structure comments are inconsistent with recorded data

Do the recording issues identified appear to be associated with a particular analyst or laboratory? Yes No

If yes, identify the analyst and/or laboratory: ____

____

TEM CONSISTENCY REVIEW AND DATA TRANSFER VERIFICATION REPORT

TEM AHERA/ASTM SELECTION AND CONSISTENCY REVIEW RESULTS

Analyst, Lab	Number of TEM 100.2 Analyses			Number of TEM 100.2 Analyses Selected for Review		
	Detect	Non-Detect	Total	Detect	Non-Detect	Total
Analyst #1, Lab Name						
Analyst #2, Lab Name						
…						
Total						

	Goal	Actual
Selected Total	_______	_______
Selected Detects	_______	_______
Selected Non-Detects	_______	_______

Detailed summary of bench sheet consistency review –

Number of analyses reviewed: _______ (_______% of total analyses selected)

If not all analyses could be reviewed, provide a brief explanation for why: ________________________________

____

Number of analyses with recording issues identified: _______ (_______% of total analyses reviewed)

Types of recording issues identified (indicate the number of analyses):

_______ Reported structure types are inconsistent with TEM 100.2

_______ Fibers recorded as countable do not meet counting rules

_______ Mineral class designation is missing or inconsistent

_______ Structure comments are inconsistent with recorded data

Do the recording issues identified appear to be associated with a particular analyst or laboratory? Yes No

If yes, identify the analyst and/or laboratory: ____

____

DATA TRANSFER VERIFICATION RESULTS

Number of analyses verified: _______ (_______% of total analyses selected)

Number of analyses with data transfer issues identified: _______ (_______% of total analyses verified)

Types of data transfer issues identified:

_______ Incorrect/missing information on analysis details (e.g., lab job number, analysis date, filter status)

_______ Incorrect/missing information on raw structure details (e.g., length, width, mineral class)

_______ F-factor calculation is incorrect or inputs are missing

_______ Air volume, dust area, sample mass, etc. reported by laboratory is inconsistent with field value

_______ Number of grid openings counted is incorrect

_______ Sensitivity calculation is incorrect or inputs are missing

_______ Total number of countable structures is incorrect

Do the data transfer issues identified appear to be associated with a particular analyst or laboratory? Yes No

If yes, identify the analyst and/or laboratory: ____

____

Comments: ____

____

____

____

APPENDIX D

ANALYTICAL REQUIREMENTS SUMMARY FORM

SAP/QAPP REQUIREMENTS SUMMARY # OU7_TK_R0_111312
SUMMARY OF PREPARATION AND ANALYTICAL REQUIREMENTS FOR ASBESTOS

SAP/QAPP Title: Background Soil Study, Sampling and Analysis Plan and Quality Assurance Project Plan for Operable Unit 7 of the Libby Asbestos Superfund Site

SAP/QAPP Date (Revision): 11/13/2012 (Revision 0)

EPA Technical Advisor: David Berry (303-312-6358 or Berry.David@epa.gov)
(contact to advise on DQOs of SAP/QAPP related to preparation/analytical requirements)

Sampling Program Overview: The primary objective of the background soil study is to document Libby Amphibole (LA) asbestos levels and associated mineralogy in background soils in and around Operable Unit 7 (OU7) of the Libby Asbestos Superfund Site. Background soil samples will be collected and prepared by the fluidized bed asbestos segregator method (FBAS) and FBAS filters analyzed for LA asbestos by TEM. The background soil samples will be sieved at the Troy sample preparation facility (SPF). The fine fraction will be analyzed by PLM-VE; the coarse fraction will be archived at the Troy SPF. Field crews will also collect Activity-Based Sampling (ABS) digging scenario air samples from the background soil samples collected. The resulting ABS air samples will be analyzed for LA asbestos by TEM. The results of this study will be used to establish background LA concentrations and mineralogy to be used for a human health risk assessment (HHRA) for OU7. Personal air samples will be collected for health and safety monitoring and analyzed by PCM.

Sample ID Prefix: TK-

Estimated Number and Timing of Field Samples:

All samples (with the possible exception of archived samples) will be collected and analyzed within the November/December 2012 timeframe (exact dates have not yet been determined). Estimated numbers of samples below do not include field QC or H&S samples.

1. 20 composite background soil samples to Troy SPF for preparation using FBAS, resulting in
    - 20 soil samples for PLM-VE analysis
    - 20 FBAS air filters for TEM analysis

2. 20 ABS air filters for TEM analysis (each sample will have a high and a low volume filter; only one will be analyzed)

1. SOIL

Soil Preparation and Analysis Requirements

Medium Code	Preparation Method	Analysis Method	Applicable Laboratory modification (current version of)
A	Soil by PLM: ISSI-LIBBY-01, Rev. 11	Fine fraction analyzed by PLM-VE: SRC-LIBBY-03, Rev. 3; coarse fraction will be archived at the Troy SPF.	LB-000073
B	Soil by FBAS: ESAT-LIBBY-01, Rev. 0 (a)	TEM: Modified ISO (details in table below)	Details below

(a) For 15 of the soil samples, the Troy SPF will generate only one FBAS filter per sample. For the other 5 soil samples, the Troy SPF will generate three replicate FBAS filters (with one set of replicate filters sent to three different labs. The sampling party will provide to the Troy SPF the list of soil samples selected for triplicate FBAS filter preparation.

FBAS Filter Preparation and Analytical Requirements:

Medium Code	Medium, Sample Type	Preparation Details				Analysis Details			Applicable Laboratory Modifications (current version of)
		Investi-gative?	Indirect Prep? (b) With Ashing	Indirect Prep? (b) Without Ashing	Filter Archive?	Method	Recording Rules (c)	Analytical Sensitivity/ Stopping Rules (d)	
B	FBAS Filter	Yes	Yes	No	Yes	TEM – Modified ISO 10312	<u>Initial Analysis using High Mag. (20,000x):</u> All asbestos L: $\geq$ 0.5 µm AR: $\geq$ 3:1 <u>Supplemental Analysis using Low Mag.</u> (5,000x): All asbestos; L:>5 µm W: $\geq$ 0.25 AR: $\geq$ 3:1	<u>High Mag.:</u> Examine a minimum of 2 grid openings in 2 grids, then continue counting until one of the following is achieved: i) an analytical sensitivity of 6.3E+03 g^{-1} is reached ii) 50 LA structures have been recorded iii) a total area of 1.2 mm^2 of filter has been examined <u>Low Mag.:</u> Examine a minimum of 2 grid openings in 2 grids, then continue counting until one of the following is achieved: i) an analytical sensitivity of 6.3E+03 g^{-1} is reached ii) 50 LA structures have been recorded (including the LA structures counted at High mag.) iii) a total area of 3.0 mm^2 of filter has been examined (including the area counted at high mag.)	LB-000016, LB-000029, LB-000066C (e), LB-000067, and LB-000085

TEM Analysis Requirements for Fluidized Bed Asbestos Segregator Preparation Quality Control Samples:

Medium Code	Medium, Sample Type	Preparation Details				Analysis Details			Applicable Laboratory Modifications (current version of)
		Investi-gative?	Indirect Prep?		Filter Archive?	Method	Recording Rules (c)	Analytical Sensitivity/ Stopping Rules (d)	
			With Ashing	Without Ashing					
C	Preparation Blank, Filter Lot Blank, Sieve Blank	No	No	No	Yes	TEM – Modified ISO 10312 (High Mag. 20,000x)	All asbestos L: $\geq$0.5 µm AR: $\geq$ 3:1	Examine 1.0 mm^2 of filter area	LB-000016, LB-000029, LB-000066, LB-000067, and LB-000085

(b) The FBAS filters to be analyzed by TEM must be between 10 to 30% loaded without uneven loading. If this is not achieved, contact the FBAS preparation laboratory to request a new FBAS filter submittal. Laboratories may elect not to analyze a filter that is 25% to 30% loaded if too many overlapping particles are observed based on professional judgment and request a new filter submittal. If a sample is suitable for direct preparation (properly loaded with no loose debris) then it should be prepared directly. If a sample is not suitable for direct preparation, then it should undergo rock flour preparation in accordance with SOP EPA-LIBBY-08.
(c) Only proceed with low magnification analysis if the high magnification analysis resulted in the recording of fewer than 50 LA structures and the specified target analytical sensitivity was not achieved.
(d) Data recording for chrysotile is not necessary, but presence of chrysotile should be noted in the analysis comments.
(e) Although a more recent version of lab mod. LB-000066 is available (LB-000066D), version LB-000066C is preferred for this study because of the need for morphology photos.

TEM/PCM Preparation and Analytical Requirements:

Medium Code	Medium, Sample Type (a)	Preparation Details: Investigative?	Preparation Details: Indirect Prep? (f) With Ashing	Preparation Details: Indirect Prep? (f) Without Ashing	Preparation Details: Filter Archive?	Analysis Details: Method	Analysis Details: Recording Rules (g)	Analysis Details: Analytical Sensitivity/ Stopping Rules	Applicable Laboratory Modifications (current version of)
D	Air, ABS digging	Yes	Yes, if material is overloaded (>25%) or unevenly loaded on filter	No	Yes	TEM – Modified ISO 10312, Annex E (Low Mag. 5,000x)	PCME asbestos; L: >5 µm W: ≥ 0.25 AR: ≥ 3:1	Examine a minimum of 2 grid openings in 2 grids, then continue counting until one of the following is achieved: i) an analytical sensitivity of 0.00022 cc^{-1} is reached ii) 25 PCME LA structures have been recorded iii) 20 mm^2 filter has been examined	LB-000016, LB-000029, LB-000066, LB-000067, and LB-000085
E	Air, Field Blank	No	No	No	Yes	TEM-Modified ISO 10312, Anne E (low mag.)	PCME asbestos; L: >5 µm W: ≥ 0.25 AR: ≥ 3:1	Examine 1.0 mm^2 of filter	LB-000016, LB-000029, LB-000066, LB-000067, and LB-000085
F	Air, Health and Safety	No	No	Yes, if material is overloaded (>25%) or if unevenly loaded on filter	Yes	PCM-NIOSH 7400, Issue 2 TEM-AHERA (upon request only)	For PCM: NIOSH 7400 "A" rules For AHERA: All asbestos; L: ≥0.5 µm AR: ≥ 5:1	For PCM: Count a minimum of 20 FOVs, then continue counting until one of the following is achieved: i) 100 fibers are recorded ii) 100 FOVs are examined (regardless of count) For AHERA: Examine 0.1 mm2 of filter.	For PCM: LB-000015 For AHERA: LB000029, LB-000031, LB000067, and LB-000085

(f) A high and a low-volume ABS filter will be collected from each background soil sample. The high volume filter should be analyzed in preference to the low volume filter if direct preparation is possible. However, if the high volume filter is overloaded, use the low volume filter. If the low volume filter is overloaded, prepare the high volume filter indirectly (with ashing) in accordance with most current version of SOP EPA-LIBBY-08; calculate the number of grid openings to analyze to reach target analytical sensitivity, and contact EPA project managers or their designate before proceeding with analysis.
(g) If observed, chrysotile and other amphibole asbestos should be recorded according to the same rules used for LA.

Laboratory Quality Control Sample Frequencies:

TEM: Lab Blank – 4% (i)
Recount Same – 1% (i)
Recount Different – 2.5% (i)
Verified Analysis – 1% (i)
Repreparation – 1% (i)
Interlab – 0.5% (i)

PCM: Blind Recounts – 10% (ii)

PLM: Lab Duplicate (self check) – 2% (iii)
Lab Duplicate (cross check) – 8% (iii)

(i) See current version of LB-000029 for selection procedure and QC acceptance criteria
(ii) See NIOSH 7400 for QC acceptance criteria
(iii) See SRC-LIBBY-03 for QC acceptance criteria

Requirements Revision:

Revision #:	Effective Date:	Revision Description
0	November 13, 2012	

Analytical Laboratory Review Sign-off:

- ☐ EMSL – Libby [sign & date: ______________________]
- ☐ EMSL – Cinnaminson [sign & date: ______________________]
- ☐ EMSL – Beltsville [sign & date: ______________________]
- ☐ EMSL – Denver [sign & date: ______________________]
- ☒ ESAT [sign & date: Douglas Kent 6 November 2012]
- ☐ Hygeia [sign & date: ______________________]
- ☐ RESI [sign & date: ______________________]

[Checking the box and initialing above indicates that the laboratory has reviewed and acknowledged the preparation and analytical requirements associated with the specified SAP/QAPP.]